ASSESSMENT OF HOUSEHOLD FOOD SECURITY AND NUTRITIONAL STATUS OF CHILDREN AGED 1-3 YEARS IN SEME SUB-COUNTY, KENYA.

BY

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DECLARATION

This thesis is my original work and has not been presented for a master's degree in any other University.

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ABSTRACT

In Sub-Saharan Africa, one out of ten households is unable to get food with more than three million children living in households that are severely food insecure. Kenya is among the top 50 countries in Sub-Saharan Africa that has failed to provide enough food for its people; with a Global Hunger Index of 21.9 denoting serious severity. Despite several efforts by the Kenyan Government to resolve household food insecurity, Seme Sub-County still has a higher number of households reporting lack of food or money to purchase food at 41.9 %. This is higher than the national rates at 36.2%. This region also has a higher under -five mortality rate at 72 deaths per 1000 live births as compared to the national rates at 52 deaths per 1000 live births. Despite all these, Seme Sub-County mothers are still more than 50% likely to practice early introduction of complementary feeding which predisposes their children to a higher risk of undernutrition (stunting, wasting and underweight). If these problems persist, then it will result to escalated under-five morbidity and mortality rates. Therefore, the main objective of this study was to assess household food security and nutritional status of children aged 1-3 years in Seme Sub-County, Kenya. The specific objectives were to assess demographic and socio-economic characteristics of the households; to determine food availability and accessibility of households; to assess child dietary intake, to determine the child nutritional status and to determine the relationship between dietary intake and nutritional status of children aged 1-3 years in households in Seme Sub-County, Kenya. The study was conducted in Seme Sub-County. The study population comprised of mothers/caregivers with children aged 1-3 years living in Seme Sub-County. The study adopted a descriptive cross sectional research design. Sample size was determined using Creative Research Systems (2003) formula. A total of 193 households with children aged 1-3 years were interviewed. Simple random sampling technique was used to select the study participants. A questionnaire was used to collect data on socio-demographic characteristics of the household, food availability and accessibility of the households and food frequency questionnaire to assess dietary intake of the child. Nutritional status of the child was assessed using anthropometric assessment. Descriptive statistics was used to summarize each of the specific objectives. Multiple linear regression was used to determine the relationship between dietary intake and nutritional status of children aged 1-3 years. Most children were stunted at (38.9%) denoting chronic malnutrition and long term food deprivation in Seme; others were underweight at (16.1%) and few were wasted at (8.8%). These rates are higher than the national Kenyan rates where stunting is at 26%; wasting is at 4% and underweight is at 11%. The high rates might be attributed to most mothers in Seme practicing early introduction of complementary feeding predisposing their children to under nutrition (stunting, underweight, wasting); poor consumption of Vitamin A rich vegetables and tubers (15.6%) by the children and most households reporting lack of food or money to purchase food at 41.9% which is still higher than the national Kenyan rate which is at 36.2%. Further, there was a statistically significant relationship between stunting and low dietary diversity, $p=0.02$ in children aged 1-3 years with chances of being stunted increasing by 12 in children aged 1-3 years consuming a lowly diversified diet holding moderate diet diversity and high dietary diversity constant, $\beta(95\%CI)=12(11.92,12.08)$. This denoted that a child who ate a lowly diversified diet was most likely to be stunted. Therefore, there is need for possible targeted and sustainable interventions to be done to cease early introduction of complementary feeding, promote household food security and improve consumption of a highly diversified diet by the children in Seme.

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ABBREVIATIONS/ACRONYMS

CHWs	Community Health Workers
FANTA	Food and Nutrition Technical Assistance
FAO	Food Agriculture Organization
HAZ	Height for Age Z-score
HFI	Household Food Insecurity
HFIAS	Household Food Insecurity Access Scale
HHD	Household
IPSOS	Institut de Publique Sondage d'Opinion Secteur
SES	Socio-economic status
SD	Standard Deviation
SPSS	Statistical Package for the Social Sciences
WAZ	Weight for Age Z-score
WFP	World Food Programme
WHZ	Weight for Height Z-score

OPERATIONAL DEFINITION OF TERMS

Complementary feeding - this refers to introducing other foods and fluids including water, besides breast milk to a baby after 6 completed months of age (180 days of life)

Dietary intake - in this study it is defined as the number of different food groups consumed over a given reference period of seven days categorized either into high dietary diversity, medium dietary diversity or low dietary diversity.

Food Accessibility - in this study it is defined as a household way of acquiring food via transport means, time covered, total household income, expenditures and psychological factors that affect food acquisition.

Food Availability - in this study it is defined as a household state of food supply via land ownership, crop production and livestock ownership.

Global Hunger Index - is a tool that measures and tracks hunger globally as well as by region and by country categorized as follows <9.8 Low Hunger; 10.0-19.9 Moderate Hunger ; 20.0-34.9 Serious Hunger ; 35.0-49.9 Alarming Hunger and >50 Extreme Hunger.

Household food security -in this study it is defined as a condition that exists when all members at all times have enough food for an active and healthy life as indicated by a household food availability, food accessibility and a child's food utilization/nutrition status.

Household Income - the combined gross income and its source of the father and mother in a household

Landed - households or families that own land legally and are occupying it.

Nutritional Status - in this study it is defined as the condition of the body in those respects influenced by the diet intake, digestion, metabolism and utilization of food by the body, to influence normal tissue repair, body building, energy requirements, growth and development for a

healthy life which is assessed using weight and height computations and interpretations to either classify a child as normal, stunted, underweight or wasted.

Normal - a child with height for age, weight for height and weight for age between +1SD and +3SD within the expected height for age, weight for height and weight for age on the basis of the WHO international growth reference

Stunting - a child with height for age less than -2SD below the expected height for age on the basis of the WHO international growth reference

Wasting - a child with weight for height less than -2SD below the expected weight for height on the basis of the WHO international growth reference

Underweight - a child with weight for age less than -2SD below the expected weight for age on the basis of the WHO international growth reference

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CHAPTER ONE
INTRODUCTION

1.1 Background of the Study

Food security is multi-dimensional in nature encompassing food supply at global, regional, national, community, household and individual levels. It further encompasses four pillars namely; food availability, food accessibility, food stability and food utilization/nutritional status. Food availability is the ability of households to acquire food via own production. Household food security is achieved by availability of physical food supply through land ownership, crop production and livestock ownership. Inability of households to produce enough food is related to low nutrient intake and poor self-reported health status (Casey et al., 2001). This is a major problem to most people especially in developing countries (Zhou et al., 2017). In spite of households not being able to produce sufficient foods, there might be adequate food supply at national and international level which doesn't guarantee food security at household level (FAO, 2008).

Food accessibility is the ability of households to acquire food physically via total household income, transport means, distance, time covered and expenditures (Milelu, Kigaru & Kuria, 2017) or psychological access to food which entails anxiety and uncertainty about the household food supply, insufficient quality (variety and preference) of the type of food and insufficient food intake and its physical consequences (Coates J, Swindale &Blinkey, 2007). Expenditure or allocation of household resources to wage or labor or food production or other activities enables households to access food either directly (food production) or indirectly (income generation). Other factors that affect household food access include socio-demographic characteristics (household head gender, household head education status) (Zhou et al., 2017). The major indicators of food accessibility include physical and psychological access to food (worrying about food acquisition and related

factors, transport means, time covered and distance) and economic access to food (total household income, expenditures).

Food utilization/ nutrition status is the health condition of a person as influenced by the intake and metabolism of nutrients. It is important to understand a child's dietary intake specifically their diet diversity since eating a variety of food is most likely to increase their nutrient adequacy and it is also associated with a child's nutritional status, (Bandoh and Kenu, 2017). World Food Programme Nutrition Policy 2012 further states that if undernutrition is addressed in the early stages of a child, their lives will be saved, and they will consequently grow healthy and to their full potential. Children in food insufficient households are more likely to report stomach aches, headaches and colds (Casey et al., 2001). Children who don't have normal nutritional status are highly vulnerable to under- nutrition (stunting, wasting, underweight) due to their high nutrient requirements for growth and susceptibility to infectious diseases such as diarrhea and respiratory infections, which might hinder nutrient absorption as well as decrease appetite. The nutrient density offered to children is usually too low to meet their daily nutrient requirements. Therefore, it is necessary to increase their diversity of foods mostly starches, proteins, fruits and vegetables in order to meet their nutrient need (NP Steyn et al, 2005).

Household food insecurity is majorly linked with socio-demographic characteristics [Household head gender, household head education status]; (Zhou et al., 2017). Food availability [land ownership, crop production, livestock ownership] (Casey et al., 2001) and food accessibility (Transport means, distance covered, total household income, expenditure, psychological factors, Milelu, et al., 2017) which in turn affect a child's dietary intake (diet diversity, Bandoh and Kenu, 2017). This consequently leads to poor child nutritional outcomes, that is, undernutrition (underweight, wasting, and stunting). This further leads to a child's poor health status, lower

cognitive and academic attainment, psychosocial problems, inadequate food intake and if not dealt with can lead to child death, (NP Steyn et al, 2005). This is asserted by Campbell 1991 whom stated that the consequences of food insecurity may include increased vulnerability to poor health outcomes in long term, sub-optimal quality of life and health (physical, social and mental well-being).

Food insecurity has become a growing concern worldwide with an estimate of over one billion people suffering from insufficient availability of dietary energy with 821 million people (one out of nine), both adults and children, being undernourished (Food and Agriculture Organization, 2018). Developing countries are mostly affected by food insecurity since 92% of the world's undernourished individuals are living in Africa and Asia (Abdullah, 2017). According to The state of food security and nutrition in the world, Sub-Saharan Africa is the most affected by undernutrition with 236 million underweight individuals in 2017 which is a rise from 181 million in 2010; with approximately one person out of four being undernourished (Food and Agriculture Organization, 2018).

Despite the efforts by both public and private sectors to assist households in being food secure, still one out of ten households are unable to secure food, with more than three million children living in severely food insecure households in Sub- Saharan Africa (Nord et al., 2005).

Kenya is one of the developing countries in Sub- Saharan Africa, being the 28th most populous country in the world with 50,471,672 individuals with a growth rate of 2.52%. Agriculture is the main contributing factor to Kenya's economy as it directly contributes 24% of the Gross Domestic Product (GDP) and 27% of GDP indirectly via linkages with other related sectors. The main objective of Kenya's agricultural sector is to achieve national food security. This is due to the country facing severe food insecurity problems caused by a high proportion of the population not

having food, with over 10 million people being food insecure and majority depending on food relief. Households also incur huge food bills due to high food prices (Ministry of Agriculture., 2009).

Kenya was ranked among the top 50 countries that failed to provide its people with enough food with a Global Hunger Index of 21.9 denoting serious hunger severity with 1.3 million Kenyans facing famine (Ngugi, 2016). Food insecurity in Kenya is majorly caused by frequent droughts in most parts of the country, high cost of domestic food production due to high input costs mostly fertilizers, large number of farmers displaced from high potential agriculture areas due to 2008 post-election violence, high global food prices and low purchasing power for a large proportion of the population due to high poverty levels. The adverse effects of undernutrition resulted to recognition by the 2010 constitution of Kenya that every child has the right to basic nutrition (Article 53) which made the government to identify seven flagship projects to improve nutrition status of children and food security levels under Vision 2030.

Despite all these efforts by the Kenyan Government, 36.2% of households in Kenya still reports lacking food or money to purchase food with 41.9% reports from Nyanza. Out of these households nationwide in Kenya, 26% of under-fives in these households are stunted, 4% are wasted and 11% are underweight with 7.6% stunted, 0% wasted and 0.4% underweights from Nyanza (Kenya National Bureau of Statistics, 2014).

In Kenya, Nyanza region has had one of the highest under-five mortality rates at 72 deaths per 1000 live births as compared to the national under five mortality rates at 52 deaths per 1000 live births, with a child in Nyanza region being two times more likely to die before the age of 5 years than a child in the Central region (Kenya National Bureau of Statistics, 2014). Undernutrition results to child death mostly, out of which, a high percentage is attributed to poor child feeding

practices such as early introduction of complementary feeding with over 820 000 under five children lives being lost due to early introduction of complementary feeding. WHO, July 2017- infant and young child feeding fact sheet, (Mutisya et al., 2015), further stated that child malnutrition contributes to 11% of child disability and has been estimated to cause nearly one third of under-five deaths in the world.

A study conducted in Kenya, in Nyanza region specifically Seme Sub-County, by Gewa C. and Chepkemboi, (2016); found that 20% of mothers of reproductive age believed that practicing exclusive breastfeeding (EBF) makes one thinner and 30% believed that practicing EBF caused breasts to sag. This was associated with these mothers being at 143% and 131% higher risk of introducing early complementary feeding. The study further found out that out of these mothers, 80% perceived that EBF should be acceptable to the child's father for them to practice it and 76% perceived that EBF should be acceptable to the in laws for them to practice it. This was significantly associated with these mothers being at 117% and 102% higher risk of introducing early complementary feeding respectively incase the child's father or the in laws didn't support EBF (Gewa C. and Chepkemboi J, 2016). In a nutshell, mothers from this region are more than 50% more likely to practice early introduction of complementary feeding due to their own beliefs which consistently showed a strong relationship with early cessation of exclusive breastfeeding before six months of the child's age. This therefore predisposes their children to undernutrition which can lead to child death.

Most Researches focused on children aged 0-5 Years. For better targeted understanding, this research specifically focused on assessing the food availability, food accessibility, dietary intake and nutritional status of children aged 1-3 years at household level. It is in this view that this study

aimed to assess the status of household food security and nutritional status of children aged 1-3 years in Seme Sub-County, Kenya.

1.2 Statement of the Problem

In Sub-Saharan Africa 90% of the populace does not have the power to resolve food insecurity with Kenya being among the top 50 countries that has failed to provide its people with enough food with a Global Hunger Index of 21.9 denoting serious severity.

Despite several efforts by the Kenyan Government to resolve household food insecurity, Seme Sub-County still has a high number of households reporting lack of food or money to purchase food at 41.9 %. This is higher than the national rates at 36.2%. This region also has a higher under -five mortality rate at 72 deaths per 1000 live births as compared to the national rates at 52 deaths per 1000 live births. Despite all this, Seme Sub-County mothers are still more than 50% more likely to practice early introduction of complementary feeding than those who do not, which predisposes their children to a higher risk of undernutrition (stunting, wasting, underweight).

Failure to address these problems will contribute to elevated food insecurity levels resulting to increased number of malnourished children who will underperform in school, limiting their future job opportunities. If these problems persist, it will result to escalated under-five morbidity and mortality rates. This will consequently cause the government to have an increased economic burden brought by incurring huge health care expenditures in a bid to curb the malnutrition problem and restoration of household food security. In addition, the government will not achieve its vision of improving the nutrition status of children and household food security in terms of food availability and accessibility. To assist in better situation analysis in Seme for appropriate impactful interventions to be made, this study thus sought to assess household food security and nutritional status of children aged 1-3 years in Seme Sub-County, Kenya.

1.3 Objectives

1.3.1 Broad Objective

To assess household food security and nutritional status of children aged 1-3 years in Seme Sub-County, Kenya.

1.3.2 Specific Objectives

1. To assess the nutritional status of children aged 1-3 years in households in Seme Sub-County, Kenya.
2. To assess the socio-demographic characteristics, economic characteristics and nutritional status of households with children aged 1-3 years in households in Seme Sub-County, Kenya.
3. To determine the relationship between household food availability and nutritional status of children aged 1-3 years in households in Seme Sub-County, Kenya
4. To determine the relationship between household food accessibility and nutritional status of children aged 1-3 years in households in Seme Sub-County, Kenya
5. To determine the relationship between the dietary intake and nutritional status of children aged 1-3 years in households in Seme Sub-County, Kenya.

1.4 Research Questions

1. What is the nutritional status of children aged 1-3 years in households in Seme Sub-County, Kenya?
2. What are the household socio-demographic characteristics, economic characteristics and nutritional status of children aged 1-3 years in households in Seme Sub-County, Kenya?
3. What is the relationship between household food availability and nutritional status of children aged 1-3 years in households in Seme Sub-County, Kenya?

4. What is the relationship between householdfood accessibility and nutritional statuses of children aged 1-3 years in households in Seme Sub-County, Kenya?
5. What is the relationship between dietary intake and nutritional status of children aged 1-3 years in households in Seme Sub-County, Kenya?

1.5 Significance of the Study

This study focused on children aged 1-3 years because it is at this age that they transit fully from breastfeeding combined with complementary feeding to consuming regular family foods. This puts them at a higher risk of inadequate nutrient supply than their exclusively breastfed infants and older counterparts; thus predisposing them to nutrient deficiencies and growth faltering due to inadequate amounts and/or poor quality of complementary feeding and family foods. This is further aggravated by high nutrient requirements for growth and susceptibility to infectious diseases such as diarrhea and respiratory infections at this age group. It might hinder nutrient absorption as well as decrease appetite. This age group is characterized by a time transition from direct maternal control of infant nutrition to indirect maternal control (Francisco et al., 2009).

This study was conducted in Seme Sub-County and was tailored to the three pillars of Household food Security (Food Availability, Food Accessibility and Food Utilization/Nutritional Status) because most households in this region reported lacking food or money to purchase food at 41.9 %. This is higher than the national rates at 36.2%. Seme also had a higher under -five mortality rate at 72 deaths per 1000 live births as compared to the national rates at 52 deaths per 1000 live births. Despite all this, Seme Sub-County mothers were still more than 50% morelikely to practice early introduction of complementary feeding which predisposed their children to a higher risk of undernutrition (stunting, wasting, underweight).

The results of this study specifically the nutritional status of the children, food availability, food accessibility and child diet diversity may be useful to government agencies and NGO's since it will help in designing targeted intervention programmes and provide a scope for better reviewing of health policies that will improve household food security and nutritional status of children aged 1-3 years.

CHAPTER TWO
LITERATURE REVIEW

2.1 Introduction

In this section, literature review has been done on nutritional status of children; socio-demographic characteristics, economic characteristics and nutritional status; food availability and food accessibility of households and diet diversity and nutritional status of children.

2.2 Nutritional Status of Children

A child can either have normal nutritional status or be undernourished. Undernutrition is the outcome of insufficient food intake (hunger) and repeated infectious diseases. Undernutrition can be classified into different nutritional status as either underweight for one's age, too short for one's age (stunted), or dangerously thin (wasted). Wasting is an indication of acute undernutrition and is at 4% in Kenya among under-fives while stunting is an indication of chronic malnutrition at 26% in Kenya among under-fives and finally underweight is a composite of both acute and chronic malnutrition and it is at 11% in Kenya. A study by Ali et al., (2014) in Tumpat and Bachok, reported underweight prevalence to be at 25.2%, stunting at 21.1% and wasting at 6.2%.; however other studies in Tumpat found out that the rates were slightly higher at 69% stunting, 63.4% underweight and 40% wasted.

According to Mittal et al., (2007), nutritional status of children may be poor due to poverty but acute undernutrition in children is greatly affected by parenteral decision making pattern as explained by Egata et al., (2014). Acute undernutrition is prevalent in families that make individual decisions (either father or mother) on child care as compared to families that made joint decisions (both parents) on the same issue.

A study done by Hernadez D and Jacknowitz A (2009); found that a child with normal nutrition status is reported to be buffered by their mother from the effects of household food insecurity.

2.2 Socio-demographic Characteristics, Economic Characteristics and Nutritional Status

Socio-demographic characteristics are crucial determinants of household food security which includes household head gender, household head education level, age, marital status, employment, income and expenditures (Mielu et al., 2017). Kassie et al., (2014) investigated the association between household head gender and food security in Kenya and found that some distinguishable and indistinguishable characteristics caused the difference in food security between male headed households and female headed households. It further explained that even if the household heads had same visible characteristics, the invisible qualities were responsible for the difference in the level of food security in the households (Kassie et al., 2014). Women are more likely to play a positive role in household food security than men because men migrate seasonally and at times permanently. Women are also solely responsible for household food preparation, preservation, and processing. The major problems faced by these women are lack of advanced production techniques due to gender biased traditions (Ibnouf, 2011). Contrary to this, Felker-Kantor & Wood (2012) found that female headed household are more insecure than male headed households. Therefore, gender of the household head as a demographic characteristic greatly impacts on the household food security status.

Amugsi et al., (2016) stated that household head educational status is an important indicator of the socio-economic status of the household. It plays a vital role on a child's nutrition status irrespective of the level of education level. This is evidenced by female headed households having women who have received minimal education level being more aware than those with no education regarding how to use available resources for improvement of their own nutritional status and of their families. Education also empowers women to make independent decisions, to be accepted by households' members and to have greater access to household resources that are significant to nutritional status

Education of the household head also plays a significant role in household food security. This is because education gives people knowledge and awareness and increases chances of obtaining a job (Zhou et al., 2017). Female education is vital since food preparation and service is done by them (Asghar and Mohammed, 2013); therefore, female headed households should be focused on and provided with social security allowance. The more educated a household head is the more food secure the household will be and vice versa (Zhou et al., 2017).

Asghar and Mohammed, (2013) stated that the total household income and household expenditure affects the households' purchasing power with low income households facing food insecurity due to high expenditure on basic needs due to increased cost of living and lack of money to purchase food. Milelu et al., (2017) assessed the economic access of food by households where the study found out that the mean household income was Ksh. 69.59.

A study done in Sri Lanka found a significant association between low monthly income and undernutrition among school going children (Lahiru Sandaruwan Galgamuwa et al, 2017). This is similar to a study done by Melki Edris, 2007 that found that household income was significantly associated with malnutrition in preschool children. Therefore, children from low income families are at a higher risk of being stunted, wasted and underweight.

2.3 Food Availability and Nutritional Status

Food availability majorly encompasses land ownership, crop production and livestock ownership. It is one of the major factors that determine household food security. A study conducted by Milelu et al., (2017) in Kitui County, Kenya; found that the mean land ownership in that study was 2.58 acres where nearly all households (98.8%) grew maize and a most participants (77.8%) owned chicken. The key challenge facing household food availability is the challenge for the agri-food system to provide for the changing food and nutrition requirements which includes economic

inequality, poverty, high population growth and globalization. These challenges can be mitigated by; accelerating sustainable agricultural growth, promoting structural transformations, addressing livelihood risks and uncertainties and fostering private and public partnerships at national level (FAO, 2015).

A study conducted in Southern Brazil by Victoria et al., (1983), found that stunting and underweight prevalence was higher among children from landless families than children from landed families. However, in El Salvador, there was no difference in the prevalence of underweight for both children from landless and landed families but the prevalence of wasting was highest in children from landless families (Vaughan S. Flinn WL, 1978). In addition, studies done in Sri Lanka (Abeyrathne S. Poleman T, 1983) and rural Kenya (Haaga J. Mason J. and Omoro FZ, 1986) found that children from landless families were more stunted than children from households that owned land. Another study conducted in Bangladesh also found out that households that did not own land had the highest prevalence of children that were underweight and wasted (Chaudhury RH, 1984). This is affirmed by a study conducted in Nepal on determinants of child nutritional status which reported a positive correlation between land ownership and nutritional status (Martorell R, Leslie J. and Moock PR, 1984). This is because of high dietary inadequacy in landless households as compared to landed households (UNICEF, 1986). Studies that don't show a positive relationship between land ownership and nutritional status may be because of lack of controlling confounding factors such as soil quality and percentage of income spent on food (Mason JB et al., 1985).

Therefore, a vast review of literature suggests that there is a strong relationship between land ownership and nutritional status. Thus, policies targeted towards land reformation for the landless are most likely to improve the nutritional status of the landless households.

2.4 Food Accessibility and Nutritional Status

Food accessibility is another factor that affects household food security via physical and psychological access to food (FAO, 2015). A study conducted by Milelu et al., (2017), assessed the physical access of food, where the study revealed that the major means of transport to acquire food was walking with 29.3% of the households covering more than 16 km to acquire food. In addition, Donald Rose and Rickelle Richards (2007) stated that short time taken to purchase food from food stores is equivalent to short distance covered to the food store with a significant relationship existing between short time taken to the food store and high consumption of fruits and vegetables.

Another study by Betebo et al., (2017) assessed the psychological factors that affected households' ability to access food where the study found out that in the past four weeks 64% of the households were worried about food shortage, 66.1% reported inability to eat preferred food., 66.5% reported to have eaten limited food variety, 55.9% ate food that they did not want to and were unable to eat the preferred variety of food due to lack of adequate resources 62.3% reported that household members had eaten smaller food amounts, 66.1 % missed meal numbers per day, 32.3% reported not having food of any kind to eat, 10.7% reported sleeping without eating food and 5.8% reported to have spent the whole day and night without eating food.

Household food insecurity might be associated with long poverty period and lack of productive resources (Barret, 2010), household head education status, household head gender, livestock ownership and remittances (Mango et al., 2014).

Anjali V Ganpule et al., 2020, found that a higher BMI of adolescents was significantly associated with higher food access. This is in line with a study conducted in Rwanda which stated that enhancing the distance to the market will help reduce the prevalence of malnutrition in children

from inception through to 2 years of age, (Dave D et al., 2019). Therefore, food accessibility and nutritional status are significantly related, (Odunze I.I et al., 2016).

2.4 Dietary Intake and Nutritional Status of Children

It is important to understand a child's dietary intake specifically their diet diversity since eating a variety of food is most likely to increase their nutrient adequacy and it is also associated with a child's nutritional status, (Bando and Kenu, 2017). WFP Nutrition Policy 2012 further states that if undernutrition is addressed in the early stages of a child, their lives will be saved and they will consequently grow healthy and to their full potential. Children in food insufficient households are more likely to report stomach aches, headaches and colds (Casey et al., 2001). Children are also highly vulnerable to under- nutrition (stunting, wasting, underweight) due to their high nutrient requirements for growth and susceptibility to infectious diseases such as diarrhea and respiratory infections, which might hinder nutrient absorption as well as decrease appetite. The nutrient density offered to most children between 1-8 years old is usually too low to meet their daily nutrient requirements. Therefore, it is necessary to give them a highly diversified diet mostly from starches, proteins, fruits and vegetables in order to meet their nutrient need (NP Steyn et al, 2005). Diet diversity can further be classified into good/high dietary diversity, medium dietary diversity and low dietary diversity based on the food groups consumed in the past seven days (Elliot V, 2011). A study conducted in Nigeria (Ogechi & Chilezie., 2017) found that most children had low dietary diversity scores at 73.5% which was attributed to food insecurity, followed by medium dietary diversity score at 25.2% and few children had high diet diversity scores (1.3%). However another study by Agbadi et al, 2017 found that 16.6% of children consumed a lowly diversified diet with most children (81.5%) feeding on grains, roots and tubers and Vitamin A rich fruits and vegetables (53.6%).The least consumed food group was eggs at 9.6% followed by legumes and

nuts at 18.6%. Fleshy foods were at 45.6%, other fruits and vegetables were at 26.6% and dairy products at 21.2%. There was also a significant correlation between household food insecurity and low dietary diversity where food insecure households didn't have access to resources that would enable them to eat a diversified diet. The study identified that children in food insecure households did not eat an adequate diverse diet.

Contrary to Abgadi et al, (2017), Bandoh and Kenu, (2017) found that the main food group consumed by children was meat and fish at 79.8%; 74% of the children consumed cereals, roots and tubers, 11% consumed Vitamin A rich foods. More than half of the children (58.8%) consumed sweets. The average dietary diversity score was 2 which were lower than the acceptable dietary diversity score of 4 or more food groups. Only 2 children had a dietary diversity score of 7. 47.2 % of the children had medium dietary diversity score. The food groups that were mostly consumed were in abundance and readily available which were linked to local availability and harvest patterns. High consumption of meat and fish by the children was good since it was most likely to increase their iron stores and reduce risk of anemia. However, the high consumption of cereals, roots and tubers; reflects the eating patterns of areas with high undernutrition rates. Most children did not consume Vitamin A rich foods (11%) which were most likely to be associated with the high rates of Vitamin A deficiency in the area which was directly linked with delayed growth and increased risk of morbidity and mortality rates in children. There was also poor consumption of fruits and vegetables at 31% which was identified as the primary underlying cause of micro-nutrient malnutrition since fruits and vegetables are rich sources of minerals and vitamins which are readily bioavailable. These results reflected that most children in the study were likely not to meet their micronutrient needs for growth. The study further suggested that the children needed to be fed a diverse diet (more than 4 food groups) to increase their consumption of nutrients leading

to improved nutritional status. The researchers therefore concluded that though the children might have had their protein and iron needs met, they lacked essential vitamins and minerals required for proper absorption and function of nutrients in the body which might affect their growth and development. Therefore, they suggested that health care workers at child welfare clinics should conduct home visits so as to constantly educate mothers and care givers on the importance of giving children a diverse diet which will in turn urge them to incorporate diverse food groups in their child's diet.

A study conducted in Western Kenya by Were G.M. et al., 2017 found that the most consumed food groups by children under five years of age were cereals at 100%, roots and tubers at 96%. This was attributed to the region having favorable climate for the growth of the staples and the staples being most affordable as compared to other foods from other food groups. Dark green vegetables were also mostly consumed at 89% since they were grown by most households. The least consumed food groups were flesh meats at 8.4% and organ meat at 12.5% The differences in the various studies may be because of the study's being conducted in different regions with different climatic conditions and at different seasons.

A study by Ogechi UP and Chilezie OV., (2017) found out there is a significant relationship between stunting and low diet diversity score among children aged 5 years and below. The researchers concluded that children with low dietary diversity scores were more likely to be stunted; therefore, the study suggested that efforts ought to be aimed at increasing diversity in meals both at home and in schools in order to benefit children at nutritional risk. This was in line with a study conducted by Rah et al., (2010) which outlined that stunting was a predictor of low dietary diversity. This could be because food insecurity is transient and not prolonged hence does not result in stunting.

On the contrary, a study conducted in rural China (Zhang et al., 2009) found that low dietary diversity score was associated with wasting and underweight but not with stunting which was attributed to the low stunting prevalence in their study sample which was a 3.2%. On the other hand, various studies in Africa specifically rural Mali (Udipi & Hooshmand., 2013); Democratic Republic of Congo (Ekesa et al., 2011) and in rural Kenya (Bukania et al., 2014) found out that there were no significant associations between stunting and low dietary diversity scores. The differences in the findings are consistent in not being associated with stunting.

In conclusion, Agbadi et al., (2017) concluded that household food security was a poor indicator of a child's diet since in his study he found out that out of 10 children in food secure households only 2 attained the minimum acceptable diet which created a gap for other researchers to find out other determinants of a child's diet. These findings were contrary to Ogechi and Chilezei (2017) findings who stated that food security was critical in determining a child's diet since families who are food secure have the economic ability to purchase food hence impacting on a child's diet positively; though they had a gap of using 24 hour recall for assessing child's diet qualitatively and not quantitatively hence they advocated for other researchers to use alternative dietary assessment methods.

The major gap identified from the literature reviewed is that most of the researchers focused on children under five years and yet children aged 1-3 years are transiting fully from breastfeeding combined with complementary feeding to fully consuming regular family foods. It is therefore critical to understand if foods are available and accessible in households with these children. This will further have an effect on how diverse the child's diet is and their overall nutritional status.

2.5 Conceptual Framework

The independent variable household food security affects the dependent variable, nutritional status. Household food security will be assessed via socio-demographic characteristics (Household head gender, household head education status, total household income, expenditure,); food availability (land ownership, crop production, livestock ownership) and food accessibility (Transport means, distance covered, psychological factors. These factors affect the household's ability to provide food for the child. They will eventually influence the child's dietary intake (diet diversity). This consequently affects a child's nutritional outcome (normal, underweight, wasted or stunted). If the household is food insecure then the child's nutritional outcome might be poor, that is, undernutrition (underweight, wasting, and stunting). This further leads to a child's poor health status, lower cognitive and academic attainment, psychosocial problems, and inadequate food intake. If not dealt with it can lead to child death. This is asserted by Campbell (1991) whom stated that the consequences of food insecurity may include increased vulnerability to poor health outcomes in long term, sub-optimal quality of life and health (physical, social and mental well-being).

Disease is a confounding factor as it is a risk to secondary malnutrition. Diseases make a child to be undernourished by making a child to have a weakened immune system, making them prone to other infections; they lose appetite, eat a poor diet that is not diversified, digest food poorly and use nutrients to fight infection. This increases their potential for and severity of malnutrition leading to death.

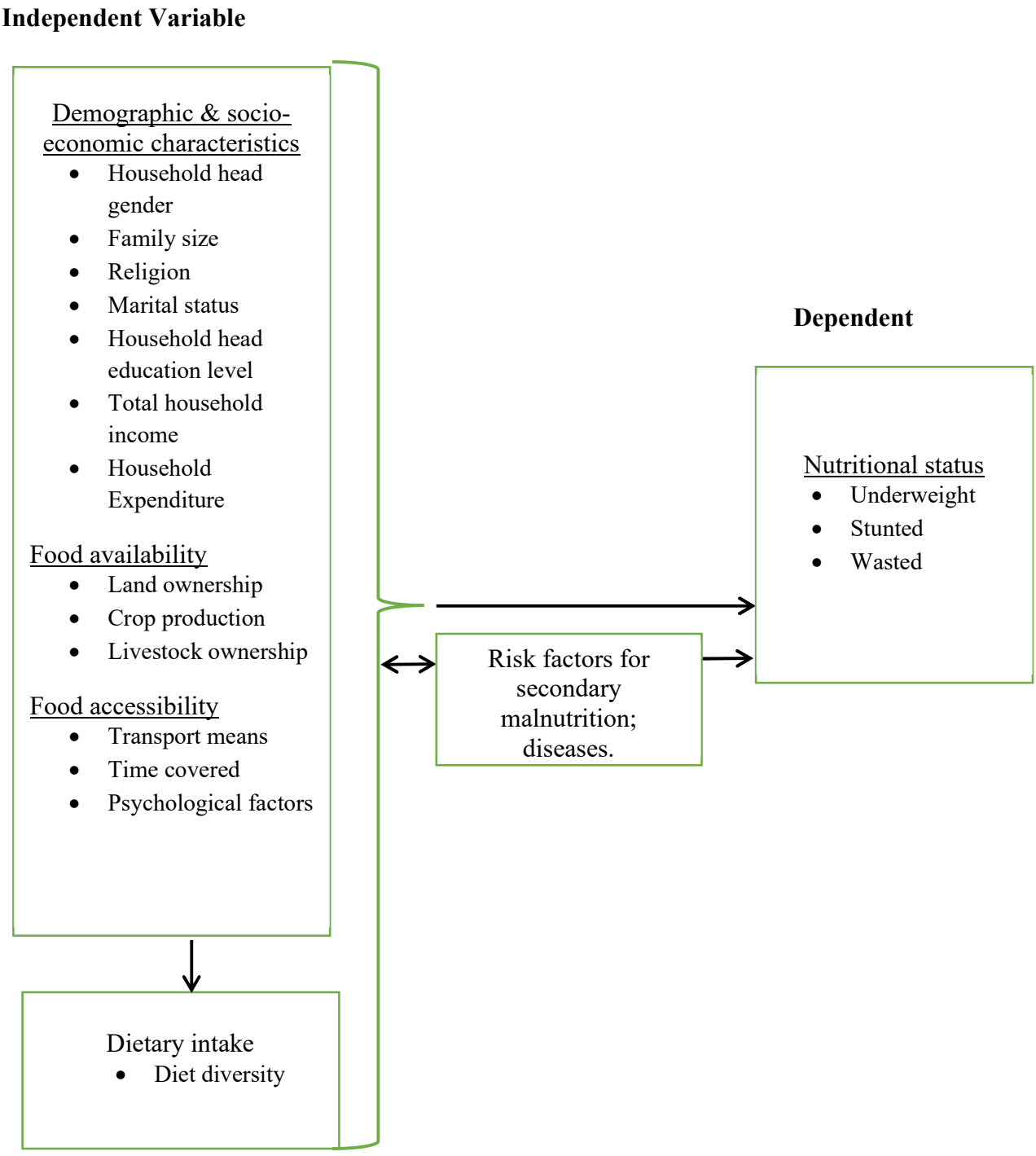

Figure 2.1 A Conceptual Framework of household Food Security and Nutritional Status adapted from Campbell's conceptual framework of consequences of household food

CHAPTER THREE
RESEARCH METHODOLOGY

3.1 Study Area

This study was conducted in Seme Sub-County which is located in the region of Kisumu West District in Kisumu County. Seme Sub-County occupies an area of 267.20 km^2 with a population density of 395 people per kilometers squared which is approximately a total population of 116,677 individuals. It is located on the shores of Lake Victoria which modifies its climate characteristics, making the area to experience a bimodal rainfall pattern with long rains occurring in April/May and short rains in December/January; with annual relief rainfall ranges between 1000mm and 1800mm and temperature ranges between 25 ^{0} c and 35^0 c. This makes the region to experience episodes of dry seasons when food is scarce and wet seasons which precede bumper harvests hence food is in plenty. Seme Sub- County is further divided into four county assembly wards namely North Seme, East Seme, Central Seme and West Seme. The study will be conducted in North Seme Ward since it is closer to an Urban Centre, Maseno, (Warren, Hawkesworth and Knai, 2015) and in West Seme Ward because it's at the shores of Lake Victoria (Bene et al., 2015).

3.2 Study Population

The study population comprised of mothers with children aged 1-3 years of age living in Seme Sub-County. There are 580 households in North and West Seme with children aged 1-3 years (MOH 515, 2017). The sampling unit was a household, and the respondent was a mother with a child aged 1-3 years old.

3.2.1 Inclusion Criteria

Households with children aged 1-3 years were included in this study.

3.2.2 Exclusion Criteria

Households with children aged 1-3 years diagnosed with chronic illness or those who were bed ridden or special children e.g. physically challenged were excluded in this study.

3.3 Research Design

A descriptive cross sectional study was adopted where data was collected once and analyzed.

3.4 Sample Size Determination and Sampling Procedure

3.4.1 Sample Size Determination

The sample size was determined using the Creative Research Systems (2003) formula, when the population was infinite. The sample was generated as follows:

SS= (Z 2) X (P) X (1-P)/ C2

Where

SS= Sample Size; Z=1.96 (for 95% level of confidence); P=0.5 (the worst percentage can ever pick a choice); C= 0.06(confident intervals).

SS= (1.962) X (0.5) X (1- 0.5)/ 0.062= 266.78 Participants

However, the Community Health Volunteers (CHVS) in the study area kept up to date records of the number of children under five years who reside within the study area. A total of 580 children aged 1-3 years old were identified from the CHVS records, hence correction for finite population was made as follows:

New SS= SS / (1+ (SS -1)/ POP)

= 266.78 / (1+ (266.78 – 1)/ 580)

=182.73

=183

A 5% non-response rate was added to cater for fall outs, giving a total sample size of 183+10=193 Participants (Betebo Bet al., 2017).

3.4.2 Sampling Procedure

Eligible households in both wards were identified from the Community Health Workers records. Simple random sampling technique was then used to select study participants. All households were assigned random numbers ranging from 1-580 and a random number table was used to select 193 participants as follows:

1. The first step was to assign all the eligible households with numbers ranging from 1-580 having determined the population size of 580 and sample size of 193.
2. The next step was to determine starting point in the random number table by randomly picking a page and dropping a finger on the page with eyes closed.
3. The third step was to choose a direction in which to read (up to down, left to right, or right to left).
4. The fourth step was to select the first 247 numbers read from the table whose last 3 digits are between 0 and 580. (This will be done because 580 is a three-digit number).
5. Once a number was chosen that number was not used again.
6. In case the end of the table was reached before obtaining the intended 193 unique numbers, another starting point was picked and reading made in a different direction and using the first 3 digits until done.

This process was blinded for the research assistants by concealing the household numbers. This was done to increase confidentiality on the household/to keep the household anonymous.

3.5 Data Collection Instruments

The tools that were used to assess household food security was a questionnaire which specifically assessed food availability and food accessibility of households; dietary intake was assessed by categorizing the food groups consumed in the past seven days and classified to a child's dietary diversity intake and anthropometry assessment form which assessed the child's nutrition status.

3.5.1 Questionnaire

A structured questionnaire was administered to the study participants. This yielded information on the demographic and socio-economic characteristics and food availability and accessibility status of the study participants. There was one questionnaire in two languages; in English and in Luo since most of the natives in Seme Sub-County are from the Luo Sub-tribe. The questionnaires were first prepared in English then translated to *Dholuo* by a certified multi-lingual translator and reviewed by a team of native Luo Speakers to get the final Luo questionnaire. (Appendix 2A).

3.5.2 Anthropometrics Assessment Form

Weight and height measurements of the child were assessed to determine their nutritional status. Anthropometric assessment tools that were used to take a child's weight was a SECA 803 weighing scale while a Shorrboard® Model: ICA (420) was used to take the child's height/length. Length of the child was taken in a recumbent position for children who could not stand, and height was taken in a standing position for children who could stand. The weight and height measurements were recorded in the anthropometric assessment form (Appendix 4).

3.5.3 Dietary Assessment Form

Child dietary assessment was done using food frequency questionnaire which gave information on the types of foods eaten and the frequency of consumption of each food group for the past seven days. This yielded information on the child's food variety intake (Appendix 3A).

3.6 Data Collection Procedures

3.6.1 Questionnaire

Data was then collected using questionnaires prepared either in English or Luo. Mothers were interviewed to obtain information on, demographic and socio-economic factors, food availability, food accessibility and child's food variety intake while the children aged 1-3 years of age were assessed to determine their nutritional status. The Community Health Volunteers (CHVs) assisted in identifying the eligible households. The household visits occurred between 9.00am and 4.00pm on weekdays. The CHVs were asked not to be present during the interviews as they worked with the mothers daily. This was to eliminate any influence their presence might have on the study participant's responses. The data collection process was checked and questionnaires filled daily to ensure data accuracy. An informed written consent was obtained from the study participants prior to administration of questionnaires. Age of the child was obtained from the Mother and Child Health booklet. The mother of the child reported the age of the child if there was no booklet which was confirmed by the CHVs since they have updated records.

The dietary assessment form was a food frequency questionnaire which was used to assess food variety intake of the children; adopted from the Food and Nutrition Technical Assistance (FANTA) project (Coates et al., 2007). This captured information of food items in the specific food groups consumed over a period of seven days. The reference period was chosen as per the Food and Agriculture Organization (FAO) guidelines for measuring household and individual dietary diversity (Sealey Potts et al., 2014). The care givers were then asked whether the children had eaten any of the food items from the main food group.

The response was either a "Yes" which was denoted by 1 or a "No" which was denoted by 0 as shown in Table 3.1.

The dietary diversity score was then calculated for each participant where the 17 food groups were re-grouped into 7 food groups as per the following table:

Table 3.1 Food Groups

FOOD GROUPS USED	FOOD GROUP USED FOR DIETARY DIVERSITY SCORE COMPUTATIONS	Yes	No
Cereals White roots and tubers Starches	Cereals, roots and tubers		
Vitamin A rich vegetables Dark green leafy vegetables Other vegetables	Vegetables		
Vitamin A rich fruits Other fruits	Fruits		
Organ meats Flesh meats Eggs Fish and sea foods	Meats, fish, sea foods and eggs		
Legume, nuts and seeds	Pulses and legumes		
Milk and milk products	Dairy products		
Oils and fats	Oils and fats		
Sweets	Not considered		
Spices, condiments ad beverages	Not considered		

Source: FAO, 2014

3.6.3 Anthropometric Assessment

Anthropometric assessment involved taking the child's height/length and weight. A Shorrboard® was used to take the child's height/length. Length of the child was taken in a recumbent position for children who could not stand and height was taken in a standing position for children who could stand. Weight for children was measured to the nearest 10g for children aged 12-24 months using SECA 803 scale and to the nearest 100g for children above 24 months using electronic weighing scales. The weight and height measurements were then used to compute nutrition indices using WHO cut-off points.

3.7 Pre-testing

The study tools specifically the questionnaire, the dietary assessment form and the anthropometry assessment form was pretested in 26 households that was 17% of the sample size (Sudman, 1983) in the study area prior to the actual data collection. These households were not included in the final study sample. Pre-testing was done by interviewing the participants to determine the effectiveness, strength, validity, reliability and weakness of the questions.

3.8 Reliability and Validity

During pre-testing, the study tools specifically the questionnaire and the dietary assessment form was checked for reliability, a test-retest method was applied. According to this method, the same questions were asked twice to the same respondents at two different times to check if they were answered the same way each time by interviewing the participants.

The weighing scale's reliability was also tested by putting a 20kg standard weight on it to see if it gives the same measure for three consecutive tests daily in the morning before data collection began.

Validity of the weighing scale was checked by using concurrent validity where the functionality of the weighing scales was checked using a standard weight of 20kg every morning before data collection began to see if it gave the same measure as the standard weight. The weighing scales' reading was then ensured that it was exactly at zero before every weight measurements.

Construct validity was also done by taking two height and weight measurements for each child. The measurements were then repeated if the variation between the two measures was greater than 0.1kg for weight and greater than 0.1cm for height. The data was then checked for completeness and cleaned before exiting each household.

3.9 Measurement of Variables

3.9.1 Independent Variable

3.9.1.1 Socio-Demographic and Economic Characteristics

This comprised data and information on household head gender, family size, religion, tribe, marital status, household head education level, total household income and expenditures. Household head gender was defined as the sex either male or female person with authority position in the household. Family size was the total number of individuals in the household. Religion was a particular system of faith and worship an individual affiliate with, tribe as a human social group that the household is from, marital status as, if the caregiver is in marriage or not; total household income as the sum of money made by the household at the end of the month; expenditure as the way the household uses money and household education level as highest level of education attained by the household head. The information that was solicited was used to assess if they affected household food security which influenced the child's diet diversity thus affecting the child's nutritional status outcome.

3.9.1.2 Food Availability and Food Accessibility

Food availability comprised of information on land ownership, crop production and livestock ownership. Land ownership was defined as the total land acres owned by the household, crop production as the different types of crops that the household plants and harvests and livestock ownership as the different types of domestic animals reared by the household. The information was collected by interviewing the respondents. The information that was collected was used to assess if the households have food to be consumed by the child who will eventually impact on the child's nutritional status outcome.

Food accessibility comprised of information on psychological factors. Psychological factors were defined as feelings of anxiety and uncertainty about the household food supply, insufficient quality of the type of food and insufficient food intake and its physical consequences. The information was collected by interviewing the respondents. The information that was collected was used to assess if the household was able to access food that the child eats which will eventually influence the child's nutritional status outcome.

3.9.1.4 Dietary Intake

This comprised information on a child's consumption of various food items from specific food groups in the past seven days by the use of a food frequency questionnaire. The information that was obtained was used to assess the food variety intake of the child which eventually influences the child's nutritional status outcome.

Diet diversity scores were calculated by summing up all the "Yes=1" responses. The range of the sum was from 0-7.

The scores were then grouped according to the following thresholds;

- 6+ - high/good dietary diversity

- 4.5– 6 – moderate dietary diversity
- <4.5 – low dietary diversity

Sweets, spices, condiments and beverages were not considered at the final grouping since they usually have poor bioavailability of micronutrients (Acham et al., 2013).

3.9.2 Dependent Variable

This comprised information a child's nutritional status outcome, underweight, stunted or wasted. Underweight was defined as children whose weight for age z scores are less than-2SD, stunted as children whose height for age z scores are less than -2SD, wasted as children whose weight for height z scores are less than -2SD, normal as children whose z-scores were between +1SD and +3SD. The length/height for age Z-score (HAZ), weight for age Z-score (WAZ) and weight for length/height Z-score (WHZ) of children was calculated. The outcomes were then defined using WHO growth standards where children whose HAZ scores were less than -2SD (Standard Deviation) were categorized as stunted, WAZ scores less than -2 SD were categorized as underweight, WHZ scores less than -2SD were categorized as wasted and WAZ, WHZ, HAZ scores between +1 SD and +3SD were categorized as normal. The information that was collected was used to determine the undernutrition prevalence.

3.10 Data Analysis

Data was cleaned, coded and entered into SPSS version 26. Descriptive statistics was used to obtain specifically mean and mode of socio-demographic characteristics; percentages for food availability and accessibility; percentages and mode for dietary intake and percentages and mode for nutritional status of children aged 1-3 years.

Inferential statistics specifically multiple linear regression was used to determine the relationship between dietary intake (high, low and moderate) and nutritional status of children (underweight,

wasted and stunted) aged 1-3 years. The data were analyzed at 95% level of significance and P-value equal to or less than 0.05 was considered significant.

3.11 Ethical Considerations

Permission to proceed with data collection was sought from the School of Graduate Studies (Appendix 5). Ethical approval was sought from Maseno University Ethics Review Committee [MUERC] (Appendix 7) and permission to conduct the research was sought from The National Commission for Science, Technology and Innovation [NACOSTI] (Appendix 6). The sub-county leaders were also informed in detail about the aim and procedures of this research and granted community entry for data collection.

This research assessed household food security and nutritional status of children aged 1-3 years. It specifically assessed demographic and socio-economic characteristics, food availability and accessibility of households and assessed the dietary intake and nutritional status of children aged 1-3 years in Seme Sub-County. The voluntary participation of all respondents was sought and subsequently their consent was obtained by signing a consent form to affirm their willingness to participate in the study. There were no foreseeable risks for participating in the research. There were no benefits for the respondents other than to further research in improving the understanding of food security issues in Seme-Sub-County. The respondents were asked questions on demographic and socio-economic characteristics, food availability, food accessibility of the households and dietary intake of the child, when they agreed to participate in the study. The child's height and weight were then taken. Any information obtained during the study remained confidential and was kept safe and private. Participants were identified using a number rather than their names in the study, so that they were not identifiable. The hard copies of the data were safely

shredded and discarded after data entry and cleaning. The electronic version of data was kept under password protected locked storage in the principal investigators office.

This study adhered to all ethical requirements for research on study respondents. These include: obtaining informed consent from the participant, ensuring confidentiality of the information collected, maintaining anonymity of the participant, storing data securely and upholding their rights. Eligible study participants were approached and decline to do so did not warrant them any form of punishment.

CHAPTER FOUR
RESULTS

4.1 Introduction

In this chapter, findings of the study are presented under the following sub-headings: description of the study participants; nutritional status of children aged 1-3 years; socio-demographic characteristics, economic characteristics and nutritional status of children aged 1-3 years; food availability of children aged 1-3 years; food accessibility and nutritional status of children aged 1-3 years and dietary intake and nutritional status of children aged 1-3 years.

4.2 Socio-demographic Characteristics, Economic Characteristics and Nutritional Status of Children Aged 1-3 Years

4.2.1 Socio-demographic Characteristics

A total of 193 households were interviewed with 103 (53.4%) of the households from West Seme Ward and 90 (46.6%) from North Seme Ward. Most households were headed by males at 166 (86%) and females at 27 (14%). The largest number of the household heads had attained a form of education at 170 (88.1%). More than half of the educated household heads had attained a maximum of primary school at 139 (72%) as the highest level of education. Most household heads were married at 170 (88.1%) with a mean household size of 5 family members. The least household size was 3 family members while the most was 15 family members. 107 (55.4%) of female children and 86 (44.6%) of male children aged 1-3 years participated in this study. Both the male and female children who participated in this study had not suffered from any illness in the past one week. More than half of the Households 103 (53.4%) were from Pentecostal faith as shown in Table 4.1.

Table 4.1 Socio-Demographic Characteristics of Participants

Characteristics	n	(%)
Location		
West Seme	103	53.4
North Seme	90	46.6
Household Head Sex		
Female	27	14
Male	166	86
Household Head Marital Status		
Married	170	88.1
Never Married	1	0.5
Separated	1	0.5
Widowed	21	10.9
Household Religion		
Catholic	28	14.5
Anglican	22	11.4
SDA	9	4.7
Pentecost	103	53.4
Legion Maria	4	2.1
Other	27	14
Educated Household Head		
No	23	11.9
Yes	170	88.1
Household Head Education Level		
None	21	10.9
Nursery	1	0.5
Primary	139	72
Secondary	25	13
College/University	7	3.6
Child Sex		
Male	86	44.6
Female	107	55.4

4.2.2 Socio- Demographic Characteristics and Nutritional Status of Children Aged 1-3 Years

Table 4.2 Socio- Demographic Characteristics and Nutritional Status of Children Aged 1-3 Years
n=193

Demographic Characteristics	Stunting			
	ά	**B**	**(95%CI)**	**R_2**
Household Head Education Status	.02*	-1.00*	(-2.92,2.08)	.254*
Female Headed Households	.01*	-3.00*	(-3.92,1.07)	.254*
Male Headed Households	.4*	-.04*	(-0.07,1.32)	.254*

*p< .05

Multiple linear regression was used to determine if there is a significant relationship between household head education status, female headed households, male headed households and stunting of children aged 1-3 years. The model predicted that about 25.4% of the total variability in stunting of a child aged 1-3 years old is explained by household head education status, male headed households and female headed households.

In addition, multiple linear regression showed that there was a significant relationship between female headed households and stunting of a child aged 1-3 years, p=0.02, where chances of getting a child aged 1-3 years with stunting decreases by 3 in households headed by females holding household head education status and male headed households constant, β(95%CI)= -3(-3.92,1.07).

Multiple linear regression further showed that there was also a significant relationship between household head education status and stunting of a child aged 1-3 years, p=0.02, where chances of getting a child aged 1-3 years with stunting decreases by 1 in households with educated heads holding female headed households and male headed households constant, β(95%CI)= -1(-2.92,2.08).

However, there was no statistical significant relationship between male headed households and stunting of a child aged 1-3 years, p=0.4, although chances of getting a child aged 1-3 years with stunting decreases by 0.04 in households with male headed households holding household head education status and female headed households constant, β(95%CI)= -0.04 (-0.07,1.32).

4.2.3 Economic Characteristics

170 (88.1%) of household heads earned income with almost all of the fathers working at 175(90.7%) and 103 (53.4%) of mothers being self-employed. The major source of income was from owned businesses at 123 (63.7%) with the most expenditure being made on food at 192 (99.5%). Compared to the previous year, most households felt that they had less income at 117 (60.6%); others felt that the income was the same at 44 (22.8%) and few felt that they made more income at 31 (16.1%). The mean amount earned by the father in the previous month was kshs 3700 with the least earning being kshs 100 while the mean amount earned by the mother in the previous month was kshs 7084 with the least earning being kshs 500. Further results are illustrated in the Table 4.3.

Table 4.3 Economic Characteristics

Characteristics	n	(%)
Household has income		
No	23	11.9
Yes	170	88.1
Compared to last year, the household income was		
More	31	16.1
Same	44	22.8
Less	117	60.6
Mother Work		
No	81	42
Yes	112	58
Mother Employed		
No	168	87
Yes	25	13
Mother Self Employed		
No	103	53.4
Yes	90	46.6
Father Work		
No	18	9.3
Yes	175	90.7
Father Employed		
No	108	56
Yes	85	44
Father Self Employed		
No	102	52.8
Yes	91	47.2
Income Source		
Government Employment	11	5.7
Non-Governmental Employment	63	32.6
Own Business	123	63.7
Farm Employment	43	22.3
Other Income Source	17	8.8
Expenditure		
School	147	76.2
Hospital/Medicine/Health	165	85.5
Veterinary Services	105	54.4
Food	192	99.5

Agriculture: seeds, fertilizer, animal feed	146	75.6
Home Improvement	123	63.7
Laborers	38	19.7
Taxes	78	40.4
Rent	45	23.3
Clothes	184	95.3
Donations	147	76.2
Drinks	125	64.8
Other Expenses	21	10.9

4.2.4 Economic Characteristics and Nutritional Status of Children Aged 1-3 Years

Multiple linear regression was used to determine if there is a significant relationship between household income and stunting of children aged 1-3 years. The model predicted that about 5.8% of the total variability in stunting of a child aged 1-3 years old is explained by household income. In addition, multiple linear regression showed that there was a significant relationship between household income and stunting of a child aged 1-3 years, p=0.03, where chances of getting a child aged 1-3 years with stunting decreases by 1 in households with income β(95%CI)= -1 (-2.04,0.65).

Table 4.4 Economic Characteristics and Nutritional Status of Children Aged 1-3 Years

n=193

Economic Characteristics	**Stunting**			
	ά	**B**	**(95%CI)**	**R_2**
Household Income	.03*	-1.00*	(-2.04,0.65)	.058*

*p< .05

4.3 Nutritional Status of Children Aged 1-3 Years

Most children in this study aged 1-3 years were stunted at 75 (38.9%), 70 (36.3%) were normal and 31 (16.1%) were underweight. The rest of the children were wasted at 17 (8.8%). The children

who were identified as being malnourished during the study were referred to Kombewa Hospital for further Nutrition Management.

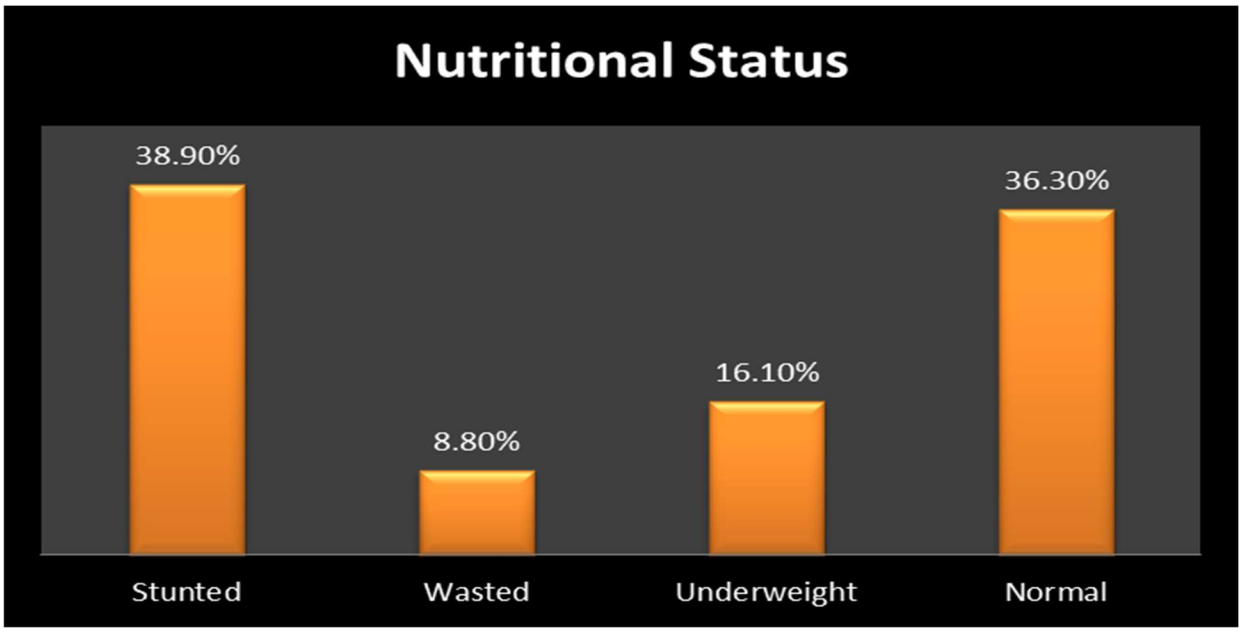

Figure 4.1 Nutritional Status of Children Aged 1-3 Years

4.4 Food Availability and Nutritional Status of Children Aged 1-3 Years

4.4.1 Food Availability of Households with Children Aged 1-3 Years

The mean land owned was 1.1 hectares, mean land rented was 0.2 hectares and mean land cultivated was 0.9 hectares. The maximum size of land owned was 50 hectares, land rented 4 hectares and land cultivated was 20 hectares. The most owned domestic animal was chicken at 159 (82.4%) with no household rearing pigs. The most produced crop was maize at 137 (71%) while millet was the least produced at 8 (4.1%). More than half of the households grew cow pea leaves at 105 (54.4%) and most produced fruit was mangoes at 95 (49.2%).

Table 4.5 Food Availability of Households with Children Aged 1-3 Years

Characteristics	n	(%)
Livestock Owned		
Cow	73	37.8
Goat	46	23.8
Sheep	27	14
Pig	0	0
Rabbit	2	1
Chicken	159	82.4
Pigeon/Doves	2	1
Other Fowls	1	0.5
Other Animals	1	0.5
Crops Produced Last Year		
Maize	137	71
Kidney Beans	67	34.7
Millet	8	4.1
Sorghum	39	20.2
Cassava	60	31.1
Sweet Potato	55	28.5
Groundnuts	71	36.8
Green grams	23	11.9
Cow Peas	51	26.4
Collard Greens	44	22.8
Cow Pea Leaves	105	54.4
Amaranth Leaves	57	29.5
Spider Plant	60	31.1
Black Night Shade	28	14.5
Mangoes	95	49.2
Guavas	82	42.5
Lemons	42	21.8
Tamarind	10	5.2

4.4.2 Food Availability and Nutritional Status of Children Aged 1-3 Years

Multiple linear regression was used to determine if there is a significant relationship between land ownership and stunting of children aged 1-3 years. The model predicted that about 60.6% of the total variability in stunting of a child aged 1-3 years old is explained by land ownership.

In addition, multiple linear regression showed that there was a significant relationship between land ownership and stunting of a child aged 1-3 years, p=0.02, where chances of getting a child aged 1-3 years with stunting decreases by 4 times in households that owned land β(95%CI)= - 4(-5.30,1.44).

Table 4.6 Food Availability and Nutritional Status of Children Aged 1-3 Years

n=193

Food Availability	**Stunting**			
	ά	**B**	**(95%CI)**	**R_2**
Land Ownership	.02*	-4.00*	(-5.30,1.44)	.606*

*p< .05

4.5 Food Accessibility and Nutritional Status of Children Aged 1-3 Years

4.5.1 Food Accessibility

More than half of the households 135 (70%) took more than one hour to reach the market to purchase food. 39 (20%) of the households took less than thirty minutes to reach the market to purchase food and 19 (10%) took thirty minutes to one hour. In the past four weeks, most households 160 (82.9%) were not able to eat the kinds of foods preferred because of lack of resources while a minimum number of households 34 (17.6%) had household members going a whole day and night without anything to eat because there was not enough food. 100 (51.8%) of households had no food to eat of any kind because of lack of resources to get food with 143 (74.1%) of households having to eat fewer meals in a day because of lack of resources to get food.

Table 4.7 Food Accessibility

Characteristics	n	(%)
Household member food accessibility perceptions in the past four weeks		
Worried that the household would not have enough food	156	(80.8)
Not able to eat the kinds of food preferred because of lack of resources	160	(82.9)
Had to eat limited variety of food due to lack of resources	149	(77.2)
Had to eat some foods that they did not want because of lack of resources	155	(80.3)
Had to eat a smaller meal than they needed because the food was not enough	148	(76.7)
Had to eat fewer meals in a day because the food was not enough	143	(74.1)
No food to eat of any kind in the household because of lack of resources to get food	100	(51.8)
Went to sleep at night hungry because the food was not enough	76	(39.4)
Went a whole day and night without eating anything because the food was not enough	34	(17.6)

4.5.2 Food Accessibility and Nutritional Status of Children Aged 1-3 Years

Multiple linear regression was used to determine if there is a significant relationship between time taken to the market and stunting of children aged 1-3 years. The model predicted that about 56.9% of the total variability in stunting of a child aged 1-3 years old is explained by the time taken to the market to purchase food.

Table 4.8 Food Accessibility and Nutritional Status of Children Aged 1-3 Years

n=193

Food Accessibility	Stunting			
	ά	**B**	**(95%CI)**	**R_2**
Time taken to the market to purchase food	.03*	2.00*	(-1.66,3.02)	.569*

*p< .05

In addition, multiple linear regression showed that there was a significant relationship between time taken to the market to purchase food and stunting of a child aged 1-3 years, p=0.03, where

increasing the time taken to the market to purchase food by 2 hours, increases the chances of getting a child aged 1-3 years with stunting in households. β(95%CI)= 2 (-1.66,3.02).

4.6 Dietary Intake and Nutritional Status of Children Aged 1-3 Years

4.6.1 Dietary Intake of Children Aged 1-3 Years

Within the last seven days, the children mostly consumed cereals (maize, maize flour, sorghum, millet, rice, wheat) at 192 (99.5%) and the least consumed was organ meats at 22 (11.4%) with half of the children having consumed a moderately diverse diet at 97 (50.3%); 60 (31.1%) of the children consumed a lowly diversified diet and 36 (18.7%) consumed a highly diversified diet in the past seven days.

Table 4.9 Dietary Intake of Children Aged 1-3 Years

Characteristics	n	(%)
Foods (meals & snacks) eaten or drank within the last 7 Days by the child		
Cereals (maize, maize flour, sorghum, millet, rice, wheat)	192	99.5
White roots and tubers (Irish potatoes, white sweet potatoes, cassava)	113	58.5
Other Starches (green bananas, matoke)	35	18.1
Vitamin A rich vegetables and tubers (pumpkin, carrot, orange sweet potatoes)	31	16.1
Dark Green leafy vegetables (kales, spinach, cowpea leaves, black nightshade, amaranthus leaves, cassava leaves, pumpkin leaves)	191	99
Other Vegetables (tomatoes, onions, cabbage, eggplant)	190	98.4
Vitamin A rich fruits (ripe mango, ripe papaya)	141	73.1
Other Fruits (oranges, lemons, melons, guavas, tamarind, unripe mango)	130	67.4
Organ Meats (liver, kidney, intestines, heart, lungs)	22	11.4
Flesh Meats (Beef, pork, chicken, lamb, goat, tongue)	53	27.5
Eggs	101	52.3
Fish and Sea food (fresh/dried fish, tilapia, omena, Nile perch e.t.c.)	185	95.9
Legumes, nuts, seeds (dried beans, green grams, cow peas, green peas, lentils, peanuts)	173	89.6
Milk & Milk Products (milk, cheese, yoghurt, ice cream)	133	68.9
Oils and Fats (oils, fats, butter, margarine, ghee)	191	99
Sweets (sugar ,honey, sodas, juice, candies)	175	90.7
Spices, condiments, beverages (spices, royco, tea, coffee, alcohol)	189	97.9
Dietary Diversity		
Low Dietary Diversity	60	31.1
Medium/Moderate Dietary Diversity	97	50.3
High Dietary Diversity	36	18.7

4.6.2 Dietary Intake and Nutritional Status of Children Aged 1-3 Years

Multiple linear regression was further used to determine if there is a significant relationship between nutritional status (underweight, wasted, stunted) and dietary diversity (low, moderate, high) of children aged 1-3 years old. The model predicted that about 80.4% of stunting in children aged 1-3 years is explained by low dietary diversity, high dietary diversity and moderate dietary diversity. There was a significant relationship between stunting and low dietary diversity, p=0.02 in children aged 1-3 years with chances of being stunted increasing by 12 in children aged 1-3 years consuming a lowly diversified diet holding moderate diet diversity and high dietary diversity constant, β(95% CI)=12 (11.92,12.08). Stunting was not significantly related to moderate diet diversity, p=1.28, and high dietary diversity, p=0.84.

In addition, the model predicted that about 42.1% of wasting in children aged 1-3 years was explained by low diet diversity, high diet diversity and moderate diet diversity with chances of being wasted decreasing by 0.13 in children aged 1-3 years consuming a highly diversified diet, β(95% CI)= -0.13 (-0.28,0.02). However, there was no statistical significant relationship between wasting and high dietary diversity, p=0.78; moderate dietary diversity, p=0.26; low dietary diversity, p=0.62.

Moreover, the model predicted that about 83.5% of underweight in children aged 1-3 years was explained by low diet diversity, high diet diversity and moderate diet diversity with chances of being underweight decreasing by 3 in children consuming a highly diversified diet, β(95%CI)= -3(-3.36,-3.06); although there was no statistical significant relationship between underweight and low dietary diversity p=0.28; moderate diet diversity p=0.08, high diet diversity, p=1.00.

Table 4.10 Dietary Intake and Nutritional Status of Children Aged 1-3 Years

n=193

Nutritional Status	Dietary Diversity									
	Low			Moderate			High			
	ά	β	(95%CI)	ά	B	(95%CI)	ά	β	(95%CI)	R_2
Stunted	.02*	12*	(11.92,12.08)	1.28*	.3*	(0.15,0.45)	.84*	.01*	(0.14,0.16)	.804*
Wasted	.62*	.13*	(0.28,0.02)	1.00*	.26*	(0.11,0.41)	.78*	1.10*	(1.25,0.95)	.421*
Underweight	.28*	.04*	(0.11,0.19)	.08*	.05*	(0.05,0.15)	1.00*	3.21*	(3.36,3.06)	.835*

*p< .05

CHAPTER FIVE
DISCUSSION

5.1 Socio-Demographic Characteristics, Economic Characteristics and Nutritional Status of Children aged 1-3 Years

Out of the 193 households interviewed in Seme, few were headed by females 27(14%) with those households being more likely to have children aged 1-3 years who are not stunted, p=0.01. The chances of getting a stunted child aged 1-3 years decreased by 3 times in households headed by females in Seme, β(95%CI)= -3(-3.92,1.07). This is similar to a study conducted by Ibnouf., (2011) who found out that female headed households were more food secure predisposing their family members to good nutrition hence they are most likely to be well nourished. At the same time, women are solely responsible for household food preparation, preservation and processing. Most women are also key decision makers to when and what a child eats. This might explain why female headed households were most likely to have children who were not stunted.

However, there was no statistical significant relationship between male headed households and stunting of a child aged 1-3 years, p=0.40. This was contrary to a study conducted by Felker and Wood (2012) in Brazil who found out that male headed households were more likely to be food secure. The differences in the findings might be because of geographical disparities.

On the other hand, household heads who had any form of education were more likely to have children aged 1-3 years who were not stunted , p=0.02, where chances of getting a child aged 1-3 years with stunting decreased by 1 in households with educated heads, β(95%CI)= -1(-2.92,2.08). This is because education gives people awareness and increases chances of obtaining a job which will consequently improve the household's food purchasing power due to economic empowerment (Zhou et al., 2017). Furthermore, education also empowers women to make independent decisions and have greater access to household resources that are significant to a child's nutritional status.

This is further supported by Amugsi et al., (2016) who stated that education makes women more aware of how to use available resources for improvement of their own nutritional status and of their families. Therefore, any form of education of the household head plays a significant role in household food security which consequently impacts on the child's nutritional status.

The mean total earnings of both the father and the mother in the previous month are similar with what nearly half of Kenyans earn monthly at Kshs 10,000 and below (Obura F., 2018). Concurrently, most mothers in Seme are self-employed as compared to the fathers at 90 (46.6%) and their mean earning of the previous month is double what working fathers earned the previous month with the largest source of income coming from owning businesses, 123 (63.7%). This is similar with the results of a survey done by IPSOS Public Affairs (Obura F., 2018) which revealed that the main source of income in Kenya was self-employment. However, the mean earnings of both the father and the mother in the previous months in Seme are higher than the mean earnings of a similar study done by Milelu et al., 2017 which was at kshs 69. This might be attributed to most household heads having gained a form of education which predisposes them to job security coupled with women self-employment and business ownership.

Both earnings made by the father and mother were mostly spent on food at 192 (99.5%) and on clothes at 184 (95.3%) as they are basic needs. Other expenses included school at 147 (76.2%); hospital/medicine/health at 165 (85.5%); veterinary services at 105 (54.4%); Agricultural input (seeds, fertilizer, animal feds) at 146 (75.6%); home improvement at 123 (63.7%); laborers at 38 (19.7%); Taxes at 78 (40.4%); rent at 45 (23.3%); donations at 147 (76.2%) and drinks at 125 (64.8%) respectively.

Compared to the previous year, more than half of the households felt that they had less income at 117 (60.6%), others felt that the income was the same at 44 (22.8%) and few felt that they made

more income at 31 (16.1%). This might be attributed to the high cost of living standards coupled with high unemployment rates in Kenya (World Bank Group., 2016)

Households in Seme with income had a significant relationship with stunted children aged 1-3 years, p=0.03 with chances of having a stunted child aged 1-3 years decreased by 1, β(95%CI)= -1(-2.04,0.65) . This is because the households have the ability to purchase food, (Zhou et al., 2017). This is asserted by Lahiru Sandaruwan Galgamuwa et al., 2017 and Melki Edris., 2007 who found out that household income was significantly associated with malnutrition in preschool children with children coming from low income families being at a higher risk of being stunted, wasted and underweight because of lack of food purchase power.

5.2 Nutritional Status of Children Aged 1-3 Years

107 (55.4%) of the households interviewed had female children and 86 (44.6%) had male children aged 1-3 years. Most of the children were stunted at 75 (38.9%), few were wasted at 17 (8.8%), some were underweight at 31 (16.1%) and the rest were normal at 70 (36.3%). These rates in Seme are higher than the national Kenyan rates where stunting is at 26%; wasting is at 4% and underweight is at 11% (Kenya National Bureau of Statistics, 2014). The higher rates might be because of a higher percentage of households reporting lack of food or money to purchase food at 41.9%. This is still higher than the national Kenyan rate which is at 36.2% (Kenya National Bureau of Statistics, 2014). This may be due to mothers in Seme practicing early introduction of complementary feeding which predisposes the children to undernutrition (stunting, wasting, underweight) (Gewa C. and Chepkemboi, 2016).

However, compared to a study done in Tumpat and Bachok by Ali et al., 2014, the underweight rates of Seme at (16.1%) are lower than the rates at Tumpat and Bachok which was at 25.2%. The wasting rate at (8.8%)and stunting rates at (38.9%) are slightly higher than the rates at Tumpat

and Bachok which are 6.2% and 21.1% respectively. The disparities might be because of different geographical settings.

In General, most children in Seme were stunted. This might be attributed to the poor consumption of Vitamin A rich Vegetables, 31 (16.1%), which makes the child's diet to be deficient in Vitamin A, a key micronutrient that is necessary for growth (Wambui E et al., 2012).The higher stunting rates is also an indication of chronic malnutrition which symbolizes long term food deprivation in terms of food security. This poses a greater risk to the children as some of the adverse outcomes associated with stunting includes; increased risk of child mortality where globally, 45% of child mortality is attributed to the different forms of malnutrition with stunting being the main contributor; increased disease risk since stunted children are at an increased risk of having repeated infection occurrence hence increased child morbidity; developmental delays; lowered ability to learn hence poor school achievement and reduced lifelong productivity since two year old stunted children were associated with a reduced likelihood of formal employment (Oot L et al., 2016).Therefore, stunting is a nutrition issue that urgently needs to be intervened in Seme.

5.3 Food Availability and Nutritional Status of Children aged 1-3 Years

The mean land owned by households in Seme was 1.1 Hectares compared to 2.58 Hectares in a similar study conducted in Kitui (Milelu et al., 2017). The difference might be attributed to the varying population size. However, in both regions, more than half of the households grew maize (Seme - [71%]; Kitui - 98.8%) and reared chicken (Seme - [82.4%]; Kitui - [77.8%]. This might be associated with maize grown as a staple food in Kenya and chicken rearing done by most households (Kenya Bureau of Statistics, 2014).

Further households that owned land in Seme had a strong statistical significance relationship with stunted children aged 1-3 years, p=0.02 with chances of getting a stunted child decreasing by 4,

β(95%CI)= -4(-5.30,1.44) . This is because of high dietary adequacy in landed households as compared to landless households (UNICEF, 1986). This is similar to a study conducted in Southern Brazil by Victoria et al., (1983), that found out that stunting and underweight prevalence was higher among children from landless families than children from landed families. However, in El Salvador, there was no difference in the prevalence of underweight for both children from landless and landed families but the prevalence of wasting was highest in children from landless families (Vaughan S. Flinn WL, 1978). In addition, studies done in Sri Lanka (Abeyrathne S. Poleman T, 1983) and rural Kenya (Haaga J. Mason J. and Omoro FZ, 1986) found out that children from landless families were more stunted than children from households that owned land. Another study conducted in Bangladesh also found out that households that did not own land had the highest prevalence of children that were underweight and wasted (Chaudhury RH, 1984). Therefore, there is a positive correlation between land ownership and nutritional status of children (Martorell R, Leslie J. and Moock PR, 1984). It is therefore necessary that land reform policies should be reviewed to ensure all households are legally landed.

5.4 Food Accessibility and Nutritional Status of Children aged 1-3 Years

The psychological factors that affected households in Seme ability to access food found out that in the past four weeks, (80.8%) of households were worried about food shortage; (82.9%) were unable to eat preferred foods; (77.2%) had eaten limited food variety; (80.3%) ate food that they didn't want to; (76.7%) ate smaller food amounts; (74.1%) missed meals per day; (51.8%) did not have food of any kind to eat; (39.4%) slept without eating food and (17.6%) spent a whole day and night without eating food.

However, the percentages of the findings are slightly higher as compared to a similar study conducted by Betebo et al., 2017 on children aged 6-59 months that found out that 64% of

households were worried about food shortage; 66.1% were unable to eat preferred foods; 66.5% had eaten limited food variety; 55.9% ate food that they didn't want to; 62.3% ate smaller food amounts; 66.1% missed meals per day; 32.3% did not have food of any kind to eat; 10.7% slept without eating food and 5.8% spent a whole day and night without eating food. The slight disparities in the findings might be because of difference in the study populations' age, although in both populations, the psychological factors affects the ability of households to access food thereby impacting on the child's nutritional status.

Further, increasing the time taken to the market to purchase food by 2 hours in households in Seme increased the chances of getting a stunted child aged 1-3 Years, β(95%CI)= 2(-1.66,3.02). This is because of the ability of the household to access food faster results to children being well nourished,(Anjali V Ganpule et al., 2020).It is in line with a study conducted in Rwanda which stated that decreasing the time taken to the market will help reduce the prevalence of malnutrition in children from inception through to 2 years of age, (Dave D et al., 2019). Therefore, food accessibility and nutritional status are significantly related, (Odunze I.I et al., 2016).It is therefore necessary to ensure that markets are decentralized to villages so that a shorter time can be taken to purchase food which would ultimately result to healthier children.

5.5 Dietary Intake and Nutritional Status of Children Aged 1-3 Years

Most children aged 1-3 years in Seme had medium diet diversity at (50.3%) and a few had high diet diversity at (18.7%). These findings are contrary to a study conducted in Nigeria (Ogechi & Chilezei, 2017) which reported that most children had low diet diversity at 73.5% followed by a medium diet diversity at 25.2%. However, in both studies, few children had high diet diversity with (18.7%) children in Seme and 13.1% of children in Nigeria having low dietary diversity. These findings might be attributed to increased food insecurity, (Ogechi & Chilezei., 2017).

Most children in Seme consumed cereals (maize, maize flour, sorghum, millet, wheat, rice) at (99.5%) with the least consumed being organ meat at (11.4%).This is concurrent with a study done in Western Kenya (Were G.M et al., 2017) that found out that children under five years mostly consumed cereals. This can be attributed to the region having favorable climate for the growth of the cereals and the cereals also being more affordable than other food groups. However the low consumption of organ meat might be because of it being costly (Were G M et al., 2017).

The consumption of Vitamin A rich vegetables and tubers was also low at (16.1%). This is similar to a study conducted by Abgadi et al., 2017 which found out that the consumption of Vitamin A rich Foods was low at 11%. This was associated with high rates of Vitamin A deficiency in the area which consequently led to most children not meeting their recommended daily micronutrient needs for growth. This might be the case with children from Seme.

There was a significant relationship between stunting and low dietary diversity, p=0.02 in children aged 1-3 years with chances of being stunted increasing by 12 in children aged 1-3 years consuming a lowly diversified diet holding moderate diet diversity and high dietary diversity constant. This showed that a child who ate lowly diversified diet was most likely to be stunted. These results are concurrent with a study done by Ogechi and Chilezei., (2017) and Rah et al., (2010); both studies found out that low diet diversity predisposes children to stunting. Therefore efforts should be aimed at increasing diet diversity both at home and at school in order to benefit the children who are at risk. A child's diet should also contain Vitamin A rich foods.

However, stunting was not significantly related to moderate diet diversity, p=1.28, and high dietary diversity, p=0.8. This suggested that a child who ate a highly or moderately diversified diet was most likely to be well nourished as he/she will be having normal nutritional status.

Moreover, the chances of being underweight decreases by 3 in children consuming a highly diversified diet although there was no significant relationship between underweight and low dietary diversity p=0.28; moderate diet diversity p=0.08, high diet diversity, p=1.00. This is contrary with a study conducted in rural China (Zhang et al., 2009) found out that low dietary diversity was associated with wasting and underweight but not with stunting which was attributed to the low stunting prevalence in their study sample which was at 3.2%. However consuming a highly diversified diet reduced the chances of underweight in children aged 1-3 years in Seme. Therefore, from the findings, a child should have a highly diversified diet in order for them to be well nourished.

CHAPTER SIX

SUMMARY OF FINDINGS, CONCLUSION AND RECOMMENDATION

6.1 Summary of Findings

Out of the 193 households interviewed in Seme, most children were stunted at (38.9%), others were underweight at (16.1%) and few were wasted at (8.8%) with more than half of the households being headed by males at (86%). Yet female headed households were least likely to have stunted children aged 1-3 years, as the chances of getting a stunted child in female headed households decreased by 3, β(95%CI)= -3(-3.92,1.07) while in male headed households the chances of getting a stunted child decreased by 0.04, β(95%CI)= -0.04(-0.07,1.32). Similarly, household heads who had attained any form of education were least likely to have stunted children aged 1-3 years with chances of being stunted decreasing by 1 in households with educated heads,β(95%CI)= -1(-2.92,2.08).

On the other hand, most fathers were employed at (44%),yet in the previous month they earned the least mean amount of kshs 3700 with the least amount earned being kshs 100 as compared to the self-employed mothers who earned double what the fathers earned at kshs 7084 with the least earning being kshs 500. The major source of income was from owning businesses, (63.7%), with the least income source coming from government employment, (5.7%) and most expenditure being made on food (99.5%).

More than half of the households grew maize at (71%) and reared chicken at (82.4%) with the mean land owned being 1.1 hectares. Most households also reported not being able to eat the kinds of food preferred because of lack of resources at (82.9%).

Half of the children ate a medium diversified diet at (50.3%) with the most consumed food group being cereals (maize, maize flour, millet, rice, sorghum, wheat) at (99.5%). The least consumed was organ meats at (11.4%) and Vitamin A rich vegetables and tubers at (16.1%).

Further, There was a statistical significant relationship between stunting and low dietary diversity, p=0.02 in children aged 1-3 years with chances of being stunted increasing by 12 in children aged 1-3 years consuming a lowly diversified diet holding moderate diet diversity and high dietary diversity constant. This showed that a child who ate lowly diversified diet was most likely to be stunted.

6.2 Conclusion

Most children in Seme Sub-County were stunted denoting chronic malnutrition which is an indicator of long term food deprivation in Seme; others were underweight and few were wasted. The high rates might be attributed to most mothers in Seme practicing early introduction of complementary feeding predisposing their children to under nutrition (stunting, underweight, wasting); poor consumption of Vitamin A rich vegetables and tubers by the children and most households reporting lack of food or money to purchase food.

In addition, the chances of getting a stunted child aged 1-3 years decreased by 3 times in households headed by females in Seme. This might be because of most women being solely responsible for household food preparation, preservation and processing. Most women are also key decision makers to when and what a child eats. This might explain why female headed households were least likely to have children who were stunted. On the other hand, household heads that had any form of education were more likely to have children aged 1-3 years who were not stunted where chances of getting a child aged 1-3 years with stunting decreased by 1 in households with educated heads. This is because education gives people awareness and increases

chances of obtaining a job which will consequently improve the household's food purchasing power due to economic empowerment. Therefore, any form of education of the household head plays a significant role in household food security which consequently impacts on the child's nutritional status.

Further, households that owned land in Seme had a strong statistical significance relationship with stunted children aged 1-3 years with chances of getting a stunted child decreasing by 4 in households that owned land. This might be because of high dietary adequacy in landed households as compared to landless households hence need for land reform policies to be reviewed so that households become landed.

Increasing the time taken to the market to purchase food by 2 hours in households in Seme increased the chances of getting a stunted child aged 1-3 Years. This is because of the ability of a household to access food faster results to children being well nourished.

There was also a statistical significant relationship between stunting and low dietary diversity, in children aged 1-3 years in Seme with chances of being stunted increasing by 12 in children aged 1-3 years consuming a lowly diversified diet. This indicated that a child who ate a lowly diversified diet was most likely to be stunted. Children should therefore consume a highly diversified diet.

Ultimately, there is need for possible targeted and sustainable interventions to be done to cease early introduction of complementary feeding, promote household food security and improve consumption of a highly diversified diet by the children in Seme.

6.3 Recommendations

6.3.1 Recommendation for Policy

The Kenyan Government is very committed to ensuring hunger and malnutrition is not a problem by having a draft on National Food Nutrition Security Policy. The draft clearly outlines the

measures taken to address food availability, food accessibility, nutrition improvement, school nutrition and nutrition awareness, food security and nutrition information and early warning and emergency management. However, it does not give a clear systematic matrix on how to:

a) Cease early introduction of complementary feeding for more children to be well nourished
b) Provide education to household heads to improve their awareness and job acquisition chances.
c) Ensure households have a piece of land through land reform policies.
d) Decentralize markets to villages to allow for shorter time to be taken to purchase foods.
e) Promote child diet diversity.

These would assist Seme Sub-County and other Counties that experience similar challenges to have a tool or a guide on how to intervene on the problem.

6.3.2 Suggestions for further Research

Further research should be done to find out the consumption of micronutrients by children in Seme.

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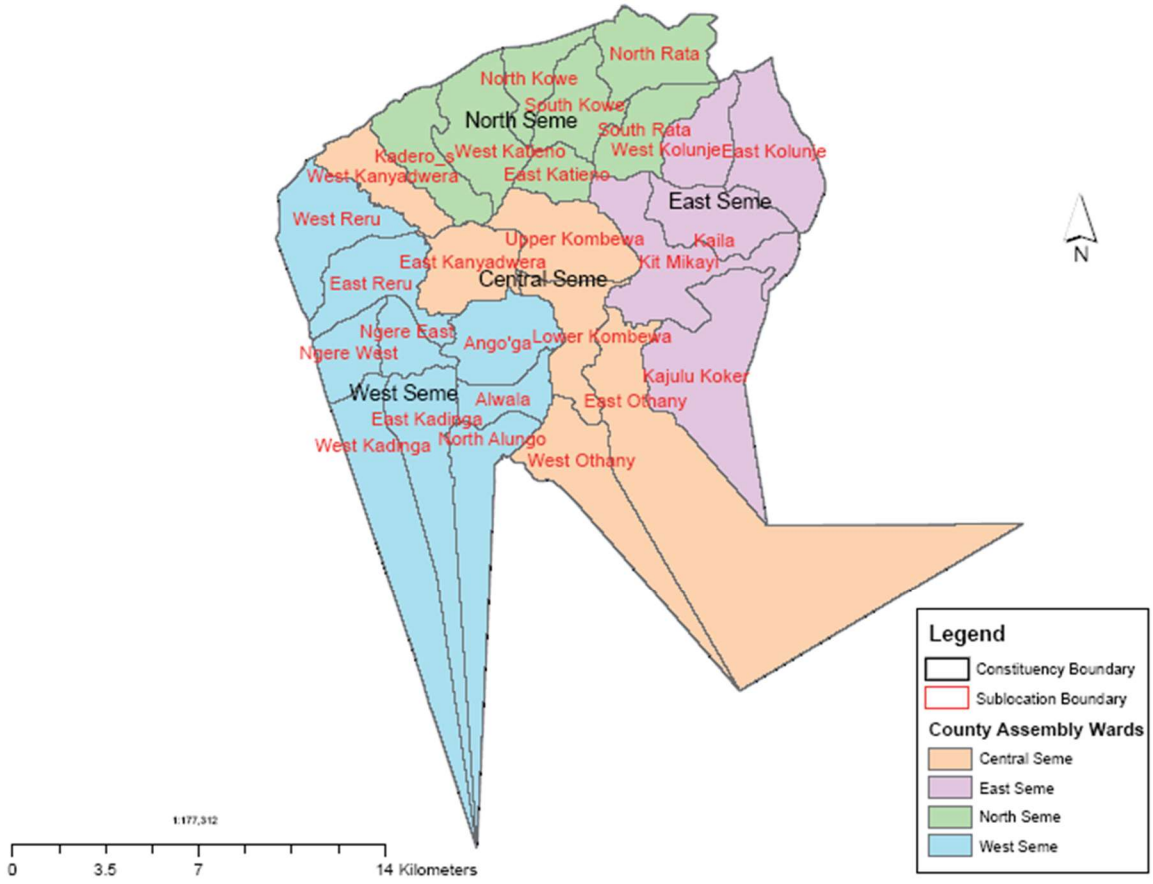
APPENDICES

Appendix 1: Map showing Seme Sub-County

- Location: Kenya, East Africa, Africa.
- Latitude: 0° 5' (0.0833°) south
- Longitude: 34° 31' (34.5167°) east
- Elevation: 1278 meters (4193 feet)



Appendix 1A: Consent Form in English

ASSESSMENT OF HOUSEHOLD FOOD SECURITY AND NUTRITIONAL STATUS OF CHILDREN AGED 1-3 YEARS IN SEME SUB-COUNTY, KENYA

RESEARCH PROCEDURES

This research is looking at food security issues specifically household food availability and accessibility in Seme Sub-County. The research will work with young children between the ages of 12 and 36 month with their caregivers. If you agree to participate, you will be asked questions on ability to obtain food for the household and frequency of consumption of particular foods by the child in the past seven days. I will measure your child's body weight and height. I will also ask you some questions about the number of children that you have, your children's age, your religion, your job and how much you make or earn.

All questions will be asked at your home. Questions about the ability to obtain food for the household and frequency of food consumption by your child will take no more than 60 minutes. Questions about the number of children that you have, your children's age, your religion, your job and how much you make or earn will last no more than 30 minutes. Measuring your child's weight and height will last no more than 30 minutes. The research activities will take a total of 2 hours.

RISKS

There are no more foreseeable risks for participating in this research. You may feel uncomfortable when the child is being measured or when providing all the information asked. The interviewer will make every effort to make you as comfortable as possible during the process. However, you may choose not to answer any questions that make you uncomfortable.

BENEFITS

There are no benefits to the child as a participant other than to further research in improving an understanding of food security issues in this area

CONFIDENTIALITY

The data in this study will be confidential. Any information obtained during this study will remain secret and kept safe and private and will only be shared with your permission. Participants will be given a number instead of using their names in the study, so they cannot be identified. The hard copies of the data will be safely discarded after data entry and cleaning. The electronic version of data will be kept under locked storage in the principal investigators office.

PARTICIPATION

You can choose to be in this study or not. Your participation is voluntary and you may get out of the study at any time and for any reason. Being or not being in this study does not cost anything. The researcher may remove you from the study if conditions arise and give reasons for doing so.

CONTACT

This research is being conducted by Wang'ara Laura Achieng'. I may be reached at 0711133901 for questions or to report a research related problem.

This research has been reviewed according to Maseno University's procedures governing your participation in this research. They can be reached at +254 57 351 622.

CONSENT

I have read this form, all of my questions have been answered by the researcher and I agree to participate in this study

Study Participant Signature ……..

Household Number ……...

Date …….

I have read this form, all of my questions have been answered by the researcher and I agree to have my child participate in this study

Study Participant Signature ……..

Household Number ……...

Date……

Appendix 1B: Consent Form in Luo

ASSESSMENT OF HOUSEHOLD FOOD SECURITY AND NUTRITIONAL STATUS OF CHILDREN AGED 1-3 YEARS IN SEME SUB-COUNTY, KENYA

NONRO.

Nonro ma atimo ni rango gik moko modok korka aina chiemo ma inyalo yud Seme ka. Ei nonro ni, aloso gi mine mantie gi nyithindo matindo (higni achiel nyaka higni 3). Ka iyie ni inyalo bedo e nonro ni, to abiro penji penjo modok kor ka chiemo ma nyathi matin chamo nyaka chiemo mayudore e dala ka. Abiro penji ni in gi nyithindo adi,chieng' nyuol margi, dini mari, tich ma itiyo, kar pesa ma ichamo kod aina cham gi jamni ma ipidho.

Penjo duto ibiro penji ei dala. Penjo maodok korka chiemo ma nyathi chamo biro kawo saa achiel gi nus. Penjo modok korka aina chiemo ma yudore e ot biro kawo dakika apar gi abich. Ibiro penji ni in gi nyithindo adi, chieng' nyuol margi,dini mari, tich ma itiyo gi kar pesa ma ichamo biro kawo dakika pier adek. Penjo gi ibiro penj mana dichiel e dala.Nonro ni duto biro kao seche ariyo.

CHANDRUOK

Ng'ato ka oyie kata ka otamore donjo e nonro ni ok be kelo chandruok mora mora. Seche moko inyalo winjo ka penjo moko tekni mondo idwok. Kik ibed gi luor. Ja tim nonro ni biro neno ni kwe nitie mondo ibed thwolo seche mi penjo penj. Bende abiro temo dwoko penjo duto ma dibed godo. Bende in gi thuolo mondo itamori duoko penjo mora mora.

YUTO

Onge yuto ma ibiro nwang'o kuom yie mondo ibed e nonro ni. Kata kamano bedo mari e nonro ni biro konyo kelo rieko e weche modok korka aina chiemo mayudore kuom anyuola ma Seme ka.

KETO SIRI

Gik moko duto ma iwacho koda, ibiro kan mopondo kendo ibiro ti go mana e nonro ni.Gigi duto inyalo mana ti godo e yo moro ma opogore ka in ema imiya thuolo.Ji duto ma biro bedo e nonro ni ibiro mi gi namba mabiro chung' kar nying gi.Abiro tiyo gi namba gi mondo omi ng'ato nono kik ng'e gima iwacho kata gima ng'ato owacho e nonro ni. Gik moko ma andiko piny abiro kano ma opondo e "kompyuta". Bang' mano oboke duto ma atiyo go e nonro ni abiro wang'o.

BEDO E NONRO.

Inyalo yie kata dagi bedo e nonro ni.Bedo ni e nonro ni en yie mari. Inyalo weyo nonro ni saa mora mora midwaro ka lure kod hero ni.Bedo kata tamruok mari mondo ibed e nonro ni ok bi hinyi e yo mora mora.Inyalo tamori duoko penjo moko ma apenjo to mano onge rach. Anyalo kwayi mondo iwe bedo e nonro ni ka ntie gima ochuno mondo iwuogi.

KAKA INYALO YUDO NG'AMA OCHUNG' NE NONRO NI.

Nonro ni itimo gi Wang'ara Laura Achieng'.Inyalo yuda e namba 0711133901 mar ong'we yamo (Mobile Phone) ka poni en gi penjo mora mora e nonro ni.

Bedo mari e nonro ni osepuodh gi mbalariany (University) mar Maseno. Inyalo yud gi e namba +254 57 351 622.

YIE

Asesomo gik mo ndik e oboke ni kendo ayie mondo abed e nonro ni;

Amuri (Signature) ……..

Namba mar ot ……...
Tarik …….
Asesomo gik mo ndik e oboke ni kendo ayie mondo nyathina obed e nonro ni;
Amuri (Signature) ……..
Namba mar ot ……...
Tarik …….

Appendix 2A Questionnaire in English

Household Number: ……. Area of interview …….

A. Demographics

Family Member First Name	Sex	HHD Head Y/N	HHD Head Education	Religion	Marital Status

KEY:

SEX

1. Yes
2. No

HHD Head

1. Yes
2. No

Religion

1. Catholic
2. Anglican
3. Baptist
4. SDA
5. Pentecost
6. Legion Maria
7. Muslim
8. Other

HHD Head Education

1. None
2. Nursery
3. Primary
4. Secondary
5. College/University

Marital Status

1. Married
2. Never married
3. Separated
4. Divorced
5. Widowed
6. Other

B. Household Socio-economic Status

1a. How Much Land (Acres) Does The Household OWN? _____

1b. How Much Land (Acres) Does the Household RENT from someone else? _____

2. How Much Land (Acres) Does The Household Cultivate? _____

3. Does your household own the following animals?

Animal	**1: Yes**	**0: No**
a. Cows		
b. Goats		
c. Sheep		
d. Pigs		
e. Rabbit		
f. Chicken		
g. Pigeons/ Doves		
h. Others		

1. Did your household produce the following crops this year?

Crops	**1: Yes**	**0: No**
a. Maize		
b. Kidney beans		
c. Soy beans		
d. Millet		
e. Sorghum		
f. Cassava		
g. Sweet potatoes		
h. Groundnuts		

i. Green grams		
j. Cow peas		
k. Collard greens		
l. Cow pea leaves		
m. Amaranth leaves		
n. Spider plant		
o. Black nightshade		
p. Mangoes		
q. Guavas		
r. Lemons		
s. Tamarind		

4. Are you (the mother) currently working? 1□Yes 0□No

a. Employed 1□Yes 0□No

b. Self-employed 1□Yes 0□No

5. What Was the Total Amount Earned By you (mother) last month? Ksh _____

6. Is the father of your child currently working? 1□Yes 0□No

a. Employed 1□Yes 0□No

b. Self-employed 1□Yes 0□No

7. What Was the Total Amount earned by him (child's father) last month? Ksh _____

8. Which of the following is a source of income for your family?

9.

Source of income/ Cash	1: Yes	0: No
a. Government Employment		
b. Non-Governmental Employment		
c. Own Business		
d. Farm Employment		
e. Other		

10. Compared to last year, the household made:

1 □ More income 2□ Same income 3 □ Less income

11. Which of the following expenses do you have each year

Expenditure	1: Yes	0: No
a. School: fees, books, uniform		
b. Hospital/ Medicine/ Health		
Veterinary services		
c. Food		
d. Agriculture input: seeds, fertilizer, animal feeds		
e. Home improvement		
f. Laborers		
g. Taxes		
h. Rent		
i. Clothes		
j. Donations		
k. Drinks		
l. Others		

C. Household Food Security Assessment

Household Number……. Area of interview……

1. In the past four weeks, did you worry that your household would not have enough food?

1. Yes
2. No (skip to Q2)

1a. How often did this happen?

1. Rarely (once or twice in the past four weeks)
2. Sometimes (three to ten times in the past four weeks)
3. Often (more than ten times in the past four weeks)

2. In the past four weeks, were you or any household member not able to eat the kinds of foods you preferred because of lack of resources?

1. Yes
2. No (skip to Q3)

2a. How often did this happen?

1. Rarely (once or twice in the past four weeks)
2. Sometimes (three to ten times in the past four weeks)
3. Often (more than ten times in the past four weeks)

3. In the past four weeks, did you or any household member have to eat a limited variety of foods due to lack of resources?

1. Yes
2. No (skip to Q4)

3a. How often did this happen?

1. Rarely (once or twice in the past four weeks)
2. Sometimes (three to ten times in the past four weeks)
3. Often (more than ten times in the past four weeks)

4. In the past four weeks, did you or any household member have to eat some foods that you really did not want to eat because of lack of resources to obtain other types of food?

1. Yes
2. No (skip to Q5)

4a. How often did this happen?

1. Rarely (once or twice in the past four weeks)
2. Sometimes (three to ten times in the past four weeks)
3. Often (more than ten times in the past four weeks)

5. In the past four weeks, did you or any household member have to eat smaller meals than you felt you needed because there was not enough food?

1. Yes
2. No (skip to Q6)

5a. How often did this happen?

1. Rarely (once or twice in the past four weeks)
2. Sometimes (three to ten times in the past four weeks)

3. Often (more than ten times in the past four weeks)

6. In the past four weeks, did you or any household member have to eat fewer meals in a day because there was not enough food?

1. Yes
2. No (skip to Q7)

6a. How often did this happen?

1. Rarely (once or twice in the past four weeks)
2. Sometimes (three to ten times in the past four weeks)
3. Often (more than ten times in the past four weeks)

7. In the past four weeks, was there no food to eat of any kind in your household because of lack of resources to get food?

1. Yes
2. No (skip to Q8)

7a. How often did this happen?

1. Rarely (once or twice in the past four weeks)
2. Sometimes (three to ten times in the past four weeks)
3. Often (more than ten times in the past four weeks)

8. In the past four weeks, did you or any household member go to sleep at night hungry because there was not enough food?

1. Yes
2. No (skip to Q9)

8a. How often did this happen?

1. Rarely (once or twice in the past four weeks)
2. Sometimes (three to ten times in the past four weeks)
3. Often (more than ten times in the past four weeks)

9. In the past four weeks, did you or any household member go a whole day and night without eating anything because there was not enough food?

1. Yes
2. No

9a. How often did this happen?

1. Rarely (once or twice in the past four weeks)

2. Sometimes (three to ten times in the past four weeks)
3. Often (more than ten times in the past four weeks)

D. Market Access

1. How long does it take you to get to the nearest market to purchase food?

   1. Less than 30 min 2.30min-1 Hour 3. More than 1 Hour

E. Morbidity Data

1. Has the child suffered from any illness in the past one week?

   1□Yes 0□No

2. If yes, which one _____

Appendix 2B: Questionnaire in Luo

Household Number: ……. Area of interview …….

A. Demographics

Nying mokwongo	**Wuoy/ Nyako**	**N'gat motelo e dala**	**N'gat motelo e dala sombe ochopo kanye**	**Dini**	**Dak**

Ji duto ma odak e ot kata dala (Key)

Wuoy/Nyako
1: Wuoy/dichuo
0: Nyako/dhako

N'gat motelo e dala
1: Ee (Yes: Y)
0: Aa (No: N)

Dini
1: Catholic
2: Anglican
3: Baptist
4: SDA
5: Pentecost
6: Legion Maria
7: Muslim
8: Other

N'gat motelo e dala sombe ochopo kanye?
1: None
2: Nurseri
3: Primar
4: Secondari
5: Mbalariany
Dak
1: En gi jaode
2: onge gi jaode
3: Opogore gi jaode
4: Oweyo jaode
5: Jaode nyasaye oseomo
6: Ma moko
Household Socio-economic status

1a. Untie gi puodho ma rom nade (ekari) _____

1b. Ukodesha puodho maromo nade kuom n'gat moro (ekari)? _____

2. Uchwoyo cham ka maromo nade (ekari)? _____

3. Bende untie gi jamni?

Jamni	**1:Ee**	**0:Aa**
a. Dhok		
b. Diek		
c. Rombo		
d. Nguruwe		
e. Apwoyo		
f. Gwen		
g. Akuru		
h. Jamni mamoko:		

4. Bende ne upidho cham aina gi higa ni?

	1:Ee	**0:Aa**
a. Oduma		
b. Oganda		

c. Soya		
d. Kal		
e. Bel		
f. Omuogo		
g. Rabuon Nyaluo		
h. Njugu		
i. Olayo		
j. N'gor		
k. Alot sukuma		
l. Alot bo		
m. Ododo		
n. Alot Akeyo		
o. Alot Osuga		
p. Maembe		
q. Mapera		
r. Ndim		
s. Chwa		

5. Sani bende ondiki kamoro kata itimo tich moro? 1□Ee 0□Aa

a. Ondiki 1□Ee 0□Aa,

b. Atimo business 1□Ee 0□Aa,

6. Ni chamo pesa maromo nade e dwe mokalo? (Ksh)_____

7. Sani bende ondik wuon nyathi kata otimo tich moro? 1□Ee 0□Aa

a. Ondike 1□Ee 0□Aa,

b. Otimo business 1□Ee 0□Aa,

8. Wuon nyathino chamo pesa maromo nade e dwe mokalo? (Ksh)_____

9. Ji loso pesa e yore mopogoreopogore. Odu kae uloso pesa eyore mage?

Kaka uloso pesa	**1:Ee**	**0:Aa**
a. Tiyo gi serikali		
b. Tiyo gi NGO		
c. Timo biashara		
d. Tiyo e puodho		

e. Timo tije mamoko:		

10. Kaingiyo higa ni gi higa mokalo, inyalowachoni higa ni, ne uloso pesa marom gi higa mokalo, pesa matin kose man'geny moingo mane uloso higa mokalo:

1 □ Pesa man'geny 2 □ Pesa ma romore 3 □ Pesa matin

11. Pesa konyo e yore man'geny. Pesa ma uloso e odu ka ujotiyogagodo e yore mage?

Expenditure	**1:Ee**	**0:Aa**
a. Gik Skul kaka chulo fees, nyiewo buks, unifom		
b. Hospital		
c. Chulo Veterinary (Daktari mar dhok)		
d. Nyiewo Chiemo		
e. Gik ma itiyogodo e pidho cham kata jamni		
f. Loso dala		
g. Chulo joma tiyonwa e pudho kata dala		
h. Chulo osuru		
i. Chulo pes ot		
j. Nyiewo lewni		
k. Chiwo Sadaka		
l. Nyiewo gik ma imadho kaka kon'go		
m. Yore mamoko ma utiyo gi pesa:		

C. Household Food Security Assessment

Household Number……. Area of interview……

1. Kuom jumbe an'gwen mokalo, bende seche moko ise bedo gi paro kata mawazo ni chiemo ma un godo ok nyal romo un duto?

1□ Ee

0□ Aa (dhi Q2)

1a. Mano notimore di di?

1□ Ok ahinya (di chiel kata diryo e jumbe an'gwen mokalo)

2□ Seche moko (di dek nyak dipar e jumbe an'gwen mokalo)

3□ Di n'gey (moingo dipar e jumbe an'gwen mokalo)

2. Kuom jumbe an'gwen mokalo, di bedi ni in kata n'gato mora mora e odu ka ne ok ochamo chiemo ma ohero nikech ne onge namna?

1□ Ee

0□ Aa (dhi Q3)

2a. Mano notimore di di?

1□ Ok ahinya (di chiel kata diryo e jumbe an'gwen mokalo)

2□ Seche moko (di dek nyak dipar e jumbe an'gwen mokalo)

3□ Di n'gey (moingo dipar e jumbe an'gwen mokalo)

3. Kuom jumbe an'gwen mokalo, bende dibedi ni in kata n'gato mora mora e odu ka ok ne nyal chamo chiemo aina mopogore opogore nikech ne onge namna?

1□ Ee

0□ Aa (dhi Q4)

3a. Mano notimore di di?

1□ Ok ahinya (di chiel kata diryo e jumbe an'gwen mokalo)

2□ Seche moko (di dek nyak dipar e jumbe an'gwen mokalo)

3□ Di n'gey (moingo dipar e jumbe an'gwen mokalo)

4. Kuom jumbe an'gwen mokalo, bende di bedi ni nochuni in kata n'gato mora mora e odu mondo ocham chiemo ma ok ohero nikech ne onge namna?

1□ Ee

0□ Aa (dhi Q5)

4a. Mano notimore di di?

1□ Ok ahinya (di chiel kata diryo e jumbe an'gwen mokalo)

2□ Seche moko (di dek nyak dipar e jumbe an'gwen mokalo)

3□ Di n'gey (moingo dipar e jumbe an'gwen mokalo)

5. Kuom jumbe an'gwen mokalo, bende di bedi ni nochuni in kata n'gato mora mora e odu mondo ocham chiemo matin ma ok orom nikech ne onge chiemo moromo?

1□ Ee

0□ Aa (dhi Q6)

5a. Mano notimore di di?

1□ Ok ahinya (di chiel kata diryo e jumbe an'gwen mokalo)

2□ Seche moko (di dek nyak dipar e jumbe an'gwen mokalo)

3□ Di n'gey (moingo dipar e jumbe an'gwen mokalo)

6. Kuom jumbe an'gwen mokalo, bende di bedi ni nochuni in kata n'gato mora mora e odu mondo ocham chiemo matin e odiochien'g achiel nikech ne onge chiemo moromo?

1□ Ee

0□ Aa (dhi Q7)

6a. Mano notimore di di?

1□ Ok ahinya (di chiel kata diryo e jumbe an'gwen mokalo)

2□ Seche moko (di dek nyak dipar e jumbe an'gwen mokalo)

3□ Di n'gey (mo ingo dipar e jumbe an'gwen mokalo)

7. Kuom jumbe an'gwen mokalo, bende di bedi ni nitie seche ma ne onge chiemo mora mora e ot nikech ne onge namna?

1□ Ee

0□ Aa (dhi Q8)

7a. Mano notimore di di?

1□ Ok ahinya (di chiel kata diryo e jumbe an'gwen mokalo)

2□ Seche moko (di dek nyak dipar e jumbe an'gwen mokalo)

3□ Di n'gey (moingo dipar e jumbe an'gwen mokalo)

8. Kuom jumbe an'gwen mokalo, bende ne nitie chien'g ma in kata n'gato mora mora e odu no dhi nindo kech gotieno nikech ne onge chiemo moromo?

1□ Ee

0□ Aa (dhi Q9)

8a. Mano notimore di di?

1□ Ok ahinya (di chiel kata diryo e jumbe an'gwen mokalo)

2□ Seche moko (di dek nyak dipar e jumbe an'gwen mokalo)

3□ Di n'gey (moingo dipar e jumbe an'gwen mokalo)

9. Kuom jumbe an'gwen mokalo, bende dibed ni in kata n'gato mora mora e odu oriyo odichien'g mangima ma ok ochiemo kendo onindo kech otieno nikech ne onge chiemo moromo?

1□ Ee

0□ Aa

9a. Mano notimore di di?

1□ Ok ahinya (di chiel kata diryo e jumbe an'gwen mokalo)

2□ Seche moko (di dek nyak dipar e jumbe an'gwen mokalo)

3□ Di n'gey (moingo dipar e jumbe an'gwen mokalo)

D. D. Market Access

1. Ikao saa marom nade mondo ichop e chiro nyiew chiemo?

1.Matin ne dakika 30 2. Dakika 30-Saa Chiel 3.Mohingo Saa Chiel

E.Morbidity Data

1**.**Bende nyathi noseyudo two mora mora juma mokalo?

1□Ee 0□Aa,

2.Ka ne otwo, en two mane? _____

Appendix 3A: Food Frequency Questionnaire

I want you to think about the foods (meals and snacks) that your young child ate or drank within the last 7 days. Did your child eat or drink these foods within the last 7 days?

Food Groups	Examples of foods in the food group	1: Yes	0: No
a. Cereals	Maize, maize flour, sorghum, millet, rice, wheat		
b. White roots and Tubers	Irish potatoes, white sweet potatoes, cassava		
c. Vitamin A rich vegetables and tubers	Pumpkins, carrots, orange sweet potatoes		
d. Dark green leafy vegetables	Kales, spinach, cowpea leaves, black nightshade, spider plant, Amaranthus leaves, cassava leaves		
e. Other vegetables	Tomatoes, onions, cabbage, eggplant		
f. Vitamin A rich fruits	Ripe mango, ripe papaya		
g. Other fruits	Oranges, lemons, melons, guavas		
h. Organ meats	Liver, kidney, intestines		
i. Flesh meats	Beef, pork, chicken, lamb, goat		
j. Eggs	Eggs, chicken, ducks, birds etc.		
k. Fish and sea foods	Fresh or dried fish: tilapia, omena, Nile perch e.t.c		
l. Legumes, nuts and seeds	Dried beans, green grams, cow peas, green peas, lentils, peanuts		
m. Milk and milk products	Milk, cheese, yoghurt		
n. Oils and fats	Oils, fats, butter, margarine, ghee		
o. Sweets	Sugar, honey, sodas, juices, candies		
p. Spices, condiments, beverages	Spices, royco, tea, coffee, alcohol		

Appendix 3B: Food Frequency Questionnaire

Q10.Daher ni ipar chiemo ma nyathi no chamo ei odiochienge abiriyo mokalo. Bende nyathino chamo chiemo mabiro penji gi?

Aina chiemo manitie e grup	**1:Ee**	**0:Aa**
a. Oduma, mchele, kal, bel, mogo mar oduma, ngano, kal kata bel.		
b. Rabuonngwachi, Rabuonnyaluo, omuogo,		
c. Rabondateda (matoke)		
d. Budho, karat, rabuon ma iyekwar		
e. Sukuma , spinach, a lot nyaluo, alotbo, osuga, akeyo, ododo, mito, apoth		
f. Nyanya, otungu, kabich		
g. Maembe mochiek, popo mochiek		
h. Machungwa, ndim, melons, mapera		
i. Chuny, matumbo, nyarongno, adundo		
j. Rin'goainamopogoreopogore: dhian'g, nguruwe, gweno, diel, rombo, akuru, aluru, winyo, apuoyo		
k. Ton'gainamopogoreopogore: gweno, akuru, winyo		
l. Rechainamopogoreopogore: omena, fulu, obambo, ngege, mbuta		
m. Oganda, ndengu, n'gor, njugu		
n. Chak, yogurt, cheese		
o. Mor salad, Blueband, mornyaluo, mordhian'g		
p. Sukari, soda, jus, tamtam, chocolate, morkich (asali		
q. Royco, chai, kahawa, pilipili, kitungusaumu, jira,		

Appendix 4: Anthropometry Assessment Form

Household number …… Area of interview ……..
Sex: Male Female

Weight

Measure 1
Interviewer 1 ……..
Interviewer 2 ……..

Measure 2
Interviewer 1 ……..
Interviewer 2 ……..

Height
Measure 1
Interviewer 1 ……..
Interviewer 2 ……..

Measure 2
Interviewer 1 ……..
Interviewer 2 ……..

Appendix 5: Permission Letter from School of Graduate Studies

MASENO UNIVERSITY
SCHOOL OF GRADUATE STUDIES
Office of the Dean

Our Ref: MSC/PH/00082/2016

Private Bag, MASENO, KENYA
Tel:(057)351 22/351008/351011
FAX: 254-057-351153/351221
Email: sgs@maseno.ac.ke

Date: 23rd April, 2018

TO WHOM IT MAY CONCERN

RE: PROPOSAL APPROVAL FOR ACHIENG' LAURA WANG'ARA — MSC/PH/00082/2016

The above named is registered in the Master of Science in Community Nutrition and Development, in the School of Public Health and Community Development, Maseno University. This is to confirm that her research proposal titled "*Assessment of Household Food Security and Nutrition Status of Children Aged 1 – 3 years in Seme Sub-County, Kenya.*" has been approved for conduct of research subject to obtaining all other permissions/clearances that may be required beforehand.

Prof. J.O.Agutu
DEAN, SCHOOL OF GRADUATE STUDIES

SCHOOL OF GRADUATE STUDIES MASENO UNIVERSITY 23 APR 2018 P.O. PRIVATE BAG, MASENO

Maseno University *ISO 9001:2008 Certified*

Appendix 6: NACOSTI Research Permit

REPUBLIC OF KENYA

NATIONAL COMMISSION FOR SCIENCE,TECHNOLOGY & INNOVATION

Ref No: 614025

Date of Issue: 07/January/2020

RESEARCH LICENSE

This is to Certify that Ms.. LAURA WANG'ARA of Maseno University, has been licensed to conduct research in Kisumu on the topic: Assessment of Household Food Security and Nutritional status of children aged 1-3 years in Seme Sub-County, Kenya for the period ending : 07/January/2021.

License No: **NACOSTI/P/20/3198**

614025

Applicant Identification Number

Director General
NATIONAL COMMISSION FOR SCIENCE,TECHNOLOGY & INNOVATION

Verification QR Code

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Appendix 7: Maseno University Ethics Review Committee (MUERC)

MASENO UNIVERSITY ETHICS REVIEW COMMITTEE

Tel: +254 057 351 622 Ext: 3050
Fax: +254 057 351 221
Private Bag – 40105, Maseno, Kenya
Email: muerc-secretariate@maseno.ac.ke

FROM: Secretary - MUERC

DATE: 25th November, 2019

TO: Laura Achieng' Wang'ara
PG/MSc/PHI/00062/2016
Department of Nutrition Health
School of Public Health and Community Development
Maseno University
P. O. Box, Private Bag, Maseno, Kenya

REF: MSU/DRPI/MUERC/00701/19

RE: Assessment of Household Food Security and Nutritional Status of Children Aged 1-3 Years In Seme Sub-County, Kenya. Proposal Reference Number MSU/DRPI/MUERC/00701/19

This is to inform you that the Maseno University Ethics Review Committee (MUERC) determined that the ethics issues raised at the initial review were adequately addressed in the revised proposal. Consequently, the study is granted approval for implementation effective this 25th day of November, 2019 for a period of one (1) year. This is subject to getting approvals from NACOSTI and other relevant authorities.

Please note that authorization to conduct this study will automatically expire on 24th November, 2020. If you plan to continue with the study beyond this date, please submit an application for continuation approval to the MUERC Secretariat by 15th October, 2020.

Approval for continuation of the study will be subject to successful submission of an annual progress report that is to reach the MUERC Secretariat by 15th October, 2020.

Please note that any unanticipated problems resulting from the conduct of this study must be reported to MUERC. You are required to submit any proposed changes to this study to MUERC for review and approval prior to initiation. Please advice MUERC when the study is completed or discontinued.

Thank you.

MASENO UNIVERSITY SECRETARY 25 NOV 2019 ETHICS REVIEW COMMITTEE

Dr. Bernard Guyah
Ag. Secretary,
Maseno University Ethics Review Committee.

Cc: Chairman,
Maseno University Ethics Review Committee.

MASENO UNIVERSITY IS ISO 9001:2008 CERTIFIED